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ADVANCED ANALYTIC COGNITION: CRITICAL THINKING

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14. ABSTRACT

Everyone agrees that intelligence analysis is an intensely cognitive process and that the quality of an analyst's cognition determines the quality of his or her analysis. In the past ten years the intelligence community has increasingly used the term *critical thinking* to describe the cognitive aspects of analysis. This report discusses the results of a research effort involving the examination of over 500 documents related to critical thinking. The author found that: 1) little agreement exists on what critical thinking is, with multiple definitions of critical thinking in the literature of both intelligence analysis and other fields; 2) a wide variation in the description of the thinking skills and dispositions required to think critically is present across all fields; 3) training courses for critical thinking can be found, in all fields, with different objectives, content, teaching approaches, and opportunities for practice; 4) customized and standardized assessment tools exist that are tailored to different theories of critical thinking; and 5) the literature contains conflicting descriptions of how to apply critical thinking to the process of intelligence analysis. The report also includes recommendations for a roadmap for research and activities that will demonstrate the utility of critical thinking to the intelligence community. These activities will also identify the best way to integrate critical thinking into intelligence analysis to gain maximum benefit throughout the entire intelligence community.

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NOTES FOR THE READER

In order to communicate the quality and content of the documents found and to accurately portray the authors' different perspectives, this document contains many passages extracted from their original publications. These passages may contain references, footnotes, table and figure numbering, formatting, and errors that are part of the original document, not this report. I used the passages as they were, with no additional editing. I suggest that you refer to the References section to obtain the source document if you would like to see the extract in its original context.

Since some of the excerpts included in this report are lengthy in order to illustrate the context and the voice of the author, I highlighted the main points of the excerpts in blue.

1.0 SUMMARY

Everyone agrees that intelligence analysis is an intensely cognitive process and that the quality of an analyst's cognition determines the quality of his or her analysis. In the past ten years, the intelligence community (IC) has increasingly used the term *critical thinking* to describe the cognitive aspects of analysis. *Critical thinking* has appeared in the IC's competency lists, governing documents, curricula, and training materials. It is described as an important contributor to effective analysis, and its lack has been identified as a contributor to analytic failures.

I conducted a research synthesis to gain a better understanding of critical thinking within and beyond the field of intelligence analysis and discovered that it is an ambiguous concept. I reviewed over 500 documents that addressed critical thinking, including 128 documents from the intelligence literature. Critical thinking is universally described as important, yet it isn't clear that all authors mean the same thing when they write about critical thinking. Critical thinking appears to be embraced as a concept without any interpretation, evaluation, or analysis to confirm that those talking about critical thinking all mean the same thing. I found:

- Little agreement on what critical thinking is, with multiple definitions of critical thinking in the literature of both intelligence analysis and other fields.
- Wide variation in the description of the thinking skills and dispositions required to think critically across all fields.
- Training courses for critical thinking, in all fields, with different objectives, content, teaching approaches, and opportunities for practice.
- Customized and standardized assessment tools that are tailored to different theories of critical thinking.
- Conflicting descriptions of how to apply critical thinking to the process of intelligence analysis.

Although critical thinking is believed to improve analysis, and, intuitively speaking, who would think otherwise, I found no reports describing how critical thinking actually improves the analytic result. The lack of agreement about what critical thinking is and how to apply it limits any demonstration of whether or not it will provide value. Without evidence identifying specifically what aspects of critical thinking actually improve analysis, current investments in advancing critical thinking throughout the intelligence community may not result in the anticipated benefit.

This report suggests a number of opportunities to validate the concept of critical thinking more rigorously and to synthesize and develop the methodologies necessary to make critical thinking a viable part of the work of the IC.

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2.0 INTRODUCTION

The *Framework for Analytic Cognition* highlighted the challenges facing the US IC:

> Starting with Pearl Harbor, the US IC has faced criticism for failing to predict or warn of future events. Numerous examples of these failures have been cited, including two of the most recent and highly publicized examples: failure to warn against the 9-11 attack and incorrectly estimating the size and substance of Iraq's weapons program. As a result, numerous groups and commissions have been established since the end of World War II to study "what went wrong."
>
> All of these efforts have resulted in proposals to "fix" the IC and thereby improve the quality of its products. While the proposals have come from different groups, a certain commonality exists between the proposals. As could be expected, an increase in resources has been proposed. However, the belief persists among both critics and supporters of the IC that the solution does not lie solely in providing more resources. Instead, an intelligence product can only be improved by obtaining improvements in both the quality and productivity of analysts. In this context, the solutions proposed, past and present, have included selecting more qualified personnel, enhancing training, developing new methodologies for analysis, and organizing analytical efforts.[1]

Beginning in the late 1990s, the specific topic of *critical thinking* has been increasingly mentioned as one of the "fixes" to improve the quality of analysis. James Asker was one of the earliest authors to highlight critical thinking:

> Grumbling lawmakers say the intelligence failure to detect India's nuclear test preparations was rooted in defects flagged long ago, but continually sidestepped by both Congress and spy agencies. A quick review led by Adm. David Jeremiah, a former vice chairman of the Joint Chiefs of Staff, produced a litany of familiar flaws: lack of critical thinking and analytic rigor, weak internal coordination, botched collection priorities, and too much reliance on technical intelligence-gathering, too little on spies.[2]

Stephen Marrin, bringing critical thinking more explicitly to the attention of the intelligence community, included this quote in several of his articles published from 2002-2004[3] about improving intelligence analysis. Marrin was one of the first to emphasize the need for critical thinking.

Stephane Lefebvre also highlighted the importance of critical thinking in 2003:

> If we accept the cognitive model developed by Operating Systems, Inc. as valid, then it becomes clear why analysts must be trained and encouraged to develop the necessary skills to think critically and innovatively. Objectivity is, as Michael Herman argues, an

[1] Kampman, C., Mangio, C., Parry, T., and Wilkinson, B. *Framework for Analytic Cognition (FAC): A Guide for Doing All-Source Intelligence Analysis*, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH, [in press], p. 2.
[2] Anonymous. "Same Ol', Same Ol'," *Aviation Week and Space Technology*, Vol. 148, No. 23, 1998, pp. 21.
[3] See Marrin, S. "CIA's Kent School: A Step in the Right Direction," *International Studies Association Conference*, New Orleans, LA, March 18, 2002; Marrin, S. "Improving CIA Analysis by Overcoming Institutional Obstacles," in *Bringing Intelligence About: Practitioners Reflect on Best Practices*, ed. R.G. Swenson, Joint Military Intelligence College, Washington, D.C., 2003, pp. 41-59; and Marrin, S. "CIA's Kent School: Improving Training for New Analysts," *International Journal of Intelligence and Counterintelligence*, Vol. 16, No. 4, 2003-2004, pp. 609-637.

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> 'elusive ideal.' This is important if intelligence analysts are to produce estimates that are as unbiased and free of logical fallacies as possible. To wit, if anything should be taken for granted it is the centrality of critical reflection, or boundary exploration and critique, to all forms of analysis. It is perhaps a poor reflection on the current analytical culture that critical thinking as an activity has to be made explicit.[59] [4]

Major George E. Lewis III also wrote about how the lack of critical thinking contributed to intelligence failures in a document published in 2005:

> Short of a lack of information, failures in thinking are perhaps the number one reason behind intelligence failures. Failures or the inability to recognize bias, understand cultural deviations, and ignoring alternative premises are only a few of the traps that an intelligence analyst can fall prey to if he/she cannot think critically. Of the eight critical skills within the core competencies of intelligence analysts, critical thinking is the most crucial and is often the least trained.[5]

In the years following the identification of the importance of *critical thinking*, it has appeared on lists of analyst competencies, is increasingly included in analyst training curricula, and is now mentioned explicitly in governing documents such as *The US Intelligence Community's Strategic Human Capital Plan*.[6] Yet it is not always clear what anyone means when the term *critical thinking* is used nor how to develop the competency in analysts in order to improve the analysis process and reduce failures caused by "a lack of critical thinking."

Noel Hendrickson noted the ongoing lack of understanding of critical thinking in intelligence analysis in 2008:

> Critical thinking appears on almost every list of the essential skills for intelligence analysts.[1] But any corresponding attempt to define critical thinking more precisely is seldom encountered. And, on those rare occasions when definitions are offered, they inevitably (albeit quite understandably) amount to new applications of existing approaches.[2] Yet, these existing approaches derive from more general academic attempts to create better thinkers and not from any specific concern for the problems of intelligence analysis. Thus, despite the undeniable importance of critical thinking in intelligence analysis, few if any attempts are made to define critical thinking specifically for intelligence.[7]

In support of Hendrickson's statement, I found a total of 21 intelligence analysis documents that contained definitions for critical thinking. Seventeen of the items had been published during or before 2008. Seven of the documents referenced existing scholarly definitions, 13 of the documents provided new, unique definitions, and some did both. No reports provided information on how critical thinking improves intelligence analysis nor gave any insight into which version of critical thinking might be the most useful for intelligence analysis.

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[4] Lefebvre, S.J. "Strategic Warning: If Surprise is Inevitable, What Role for Analysis? POSTER Presentation TC99," *International Studies Association (ISA) 44th Annual International Convention*, Portland, OR, February 25 - March 1, 2003, pp. 23-24.

[5] Lewis, G.E. *Army Intelligence Analysis: Transforming Army Intelligence Analysis Training and Doctrine to Serve the Reasonable Expectations and Needs of Echelons Corps and Below Commanders, Consumers, and Customers*, ADA435988, United States Army Command and General Staff College, Ft. Leavenworth, KS, 2005, p. 32.

[6] Anonymous. *The US Intelligence Community's Strategic Human Capital Plan: An Annex to the US National Intelligence Strategy*, Office of the Director of National Intelligence, Washington, D.C., 2006.

[7] Hendrickson, N. "Critical Thinking in Intelligence Analysis," *International Journal of Intelligence and Counterintelligence*, Vol. 21, No. 4, 2008, p. 679.

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Critical thinking's multiple definitions, the varied descriptions of how to apply critical thinking to intelligence analysis, and the lack of information demonstrating the benefit of critical thinking illustrate the need for a better understanding of critical thinking and how it might support effective intelligence analysis. While we can intuitively accept that improvements in cognitive processes described by the term *critical thinking* can improve analysis, it would be beneficial to reach agreement on specifically what leads to the desired cognitive improvements, including such topics as thinking skills, thinking dispositions, and effective training.

2.1 Purpose

The purpose of this research synthesis is to provide an understanding of the concept of critical thinking, how the concept is represented in the intelligence literature, and its potential applicability to intelligence analysis. We hoped to learn:

- What is critical thinking?
- What is the state of knowledge regarding critical thinking?
- Can we train someone to think critically?
- Can we assess someone's ability to think critically?
- How can this understanding of critical thinking be applied to improving intelligence analysis?

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3.0 METHODS, ASSUMPTIONS, AND PROCEDURES

This project builds upon work completed in the *State of Knowledge Relative to Intelligence Analysis*[8] project. The initial documents searched were those collected for the state of knowledge project. As a result of the close relationship between projects, the critical thinking project followed many of the same practices used in the state of knowledge project including:

- Use of the RefWorks Bibliographic Management System as the database for the project bibliography.
- Search in a wide-range of topics and professions beyond intelligence analysis.
- Use of a two-level determination of document relevance and usefulness for new documents:
  - Level 1 to occur during active searching, providing an initial determination of relevance. Those items determined to be relevant at this stage were saved for later review. All saved documents were entered into RefWorks.
  - Level 2 to occur during the document review process to determine usefulness, with keyword descriptors added to RefWorks to identify the specific kind of information contained in the document. "Useful" was based on whether the document would add new knowledge or a new perspective. (For example, we did not save every logic textbook or every book or article describing a theoretical approach to teaching critical thinking.)
- Integration of new documents into the existing intelligence analysis repository rather than creating a separate critical thinking repository with duplicate documents. All critical thinking documents are assigned the keyword **CT** as a descriptor.
- Reread all documents a second time after developing a baseline of understanding from the initial review.

3.1 Information Acquisition

In addition to the field of intelligence analysis, modern research and reflection on critical thinking encompasses multiple fields of study, including philosophy, psychology, education, communications, accounting, and medicine. The search conducted for this study resulted in documents addressing critical thinking concepts from each of the fields of study named, as well as information on assessments, training, guidelines, application, and research results.

After securing a sufficient number of documents to provide a working understanding of critical thinking, I focused on identifying:

- Early 20th Century documents to understand the genesis of the term *critical thinking.*
- Recently published documents to gain the most up-to-date theory and knowledge regarding critical thinking.
- Documents specifically focused on critical thinking in intelligence analysis.
- Documents that described lessons learned from studies in various fields about the efficacy of teaching or assessing critical thinking.

The steps I used to identify potentially relevant documents were:

[8] *State of Knowledge Relative to Intelligence Analysis*, Contract Number FA8650-05-C-6556, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH. Contract conducted January 2007- December 2010.

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1. Search all documents in the intelligence analysis repository for the term *critical thinking*.
2. For those documents identified as pertaining to critical thinking, search the individual document to find what was said.
3. Review reference lists in documents pertaining to critical thinking to identify additional documents to review and evaluate. Searching the references provided a very rich source of information.
4. Use Google search to identify additional documents, articles, and resources. Search terms included: "critical thinking," "critical thinking assessment," "critical thinking training," "critical thinking and intelligence analysis," "critical reasoning," author names, article and document names found in references within documents, and tools or resources mentioned in documents.
5. Follow interesting leads to other relevant journals, web sites, new documents, new authors, and new tools.

The search was careful, but it was not exhaustive. For example, a search of "critical thinking" on Google returned 417,000 results. A search of Amazon.com for "critical thinking" returned a possible 4,708 books, while a search of the term "thinking critically" returned a more reasonable number of 190 books. When faced with this volume of results, I reviewed the initial pages of retrieved items to determine relevance then moved on to new sources or search terms when the pages began to contain items of little relevance.

3.2 Documents in the Repository

The documents reviewed for relevance to critical thinking represent not only a variety of fields, but also were written to serve a wide variety of purposes. The majority of documents did not describe or report on experiments and studies about critical thinking.[9] Rather, the majority of the documents fit into the following categories:

- Discussions of theories about thinking, critical thinking, or related topics such as analogy or deductive thinking. Typically these theories are presented as fact.
- Textbooks proposing how to think critically or how to teach thinking.
- Publications that proposed methods for applying critical thinking.
- Results of academic research that contribute new perspectives or knowledge on critical thinking or a related topic.
- Course descriptions or syllabi that included critical thinking as a primary focus or as one topic in the course.
- Documents about some other topic such as intelligence analysis that mention critical thinking briefly or discussed critical thinking with respect to the primary topic.

Those documents that reported on experiments or studies fell into multiple categories as well:

[9] The difficulty in finding empirical studies of critical thinking was also noted by Claudia María Álvarez Ortiz in her Master's Thesis (Ortiz, C.M.A. *Does Philosophy Improve Critical Thinking Skills?* MA thesis, University of Melbourne, 2007).

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- True experiments testing a theory with a well-designed study including control groups or comparisons to groups that did not participate in the experiment such as Glaser's *An Experiment in the Development of Critical Thinking.*[10]
- Summaries of reports on widely varying initiatives such as *Teaching and Measuring Critical Thinking,*[11] which summarized the results of attempts to include critical thinking in nursing education.
- Studies of a single tool designed to enhance one aspect of critical thinking such as the report on the use of an automated argument analysis tool in *Argument Maps Improve Critical Thinking.*[12]
- Reports of long term studies to develop and test a theory such as King and Kitchener's Reflective Judgment Model.[13]
- Meta-analyses of existing empirical studies on the results of various approaches to teaching critical thinking such as *Does Philosophy Improve Critical Thinking Skills*?[14]

3.3 This Report

This report evaluates and summarizes the results of the research described above, with an emphasis on how *critical thinking* might apply to intelligence analysis.

The volume of writing about critical thinking precludes a comprehensive summary in this report of all of the critical thinking documents in the repository. I selected publications for inclusion that illustrate the history of the term, reflect the current state of knowledge, demonstrate a breadth of understanding across disciplines, describe lessons learned, or pertain to intelligence analysis.

The remainder of the report is organized as follows:

- Results and discussion
  - What is critical thinking?
  - Enablers of critical thinking: skills, dispositions, and personal epistemology
  - Can we train someone to think critically?
  - Assessing critical thinking
  - Critical thinking in the intelligence analysis literature
- Conclusions
- Appendix A - Critical Thinking Definitions

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[10] Glaser, E.M. *An Experiment in the Development of Critical Thinking,* AMS Press Inc., New York, NY, 1941.
[11] Jones, E.A., Hoffman, S., Moore, L.M., Ratcliff, G., Tibbetts, S. & Click, B.A.L. *National Assessment of College Student Learning: Identifying College Graduates' Essential Skills in Writing, Speech and Listening, and Critical Thinking. Final Project Report,* National Center on Post Secondary Teaching, Learning, and Assessment, University Park, PA, 1995.
[12] Twardy, C.R. *Argument Maps Improve Critical Thinking,* Monash University, Melbourne, Victoria, Australia, [undated].
[13] See King, P.M. & Kitchener, K.S. *Developing Reflective Judgment: Understanding and Promoting Intellectual Growth and Critical Thinking in Adolescents and Adults,* Jossey-Bass Publishers, San Francisco, CA, 1994 and King, P.M. & Kitchener, K.S. "The Reflective Judgment Model: Twenty Years of Research on Epistemic Cognition," in *Personal Epistemology: The Psychology of Beliefs about Knowledge and Knowing,* eds. B.K. Hofer & P.R. Pintrich, L. Erlbaum Associates, Mahwah, NJ, 2002, pp. 37-61.
[14] Ortiz, C.M.A. *Does Philosophy Improve Critical Thinking Skills?* MA Thesis, University of Melbourne, 2007.

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- References
- List of Acronyms

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4.0 RESULTS AND DISCUSSION

4.1 What is Critical Thinking?

Little agreement exists about what critical thinking is, as illustrated by the fact that I found 118 unique definitions of critical thinking. This lack of agreement is due primarily to the fact that critical thinking is only a theoretical concept. The term is typically used to describe a quality of thinking expected to result in high quality outcomes. However, since critical thinking is a theoretical concept, it can't be touched, can't be weighed or measured physically, and can't be easily recognized when someone is engaged in it. The concept is understood and described through the lens of the education and experiences of the person creating the description.

A method to prove or disprove any of the definitions does not exist. The definitions can only be accepted as useful or rejected as inadequate by readers based on their own education and experiences, on their familiarity with the specific terms used, and on the intended application of the concept of critical thinking.

Some of the lenses through which critical thinking can be understood include:

- Philosophy: Philosophers believe that critical thinking originated with the earliest Greek philosophers, and it remains a key element of philosophy and logic today.
- Education: Educators are interested in ensuring the K-12 educational system adequately addresses critical thinking for all students. They are interested in how to teach critical thinking and what the outcomes of critical thinking might be.
- Psychology: Cognitive psychologists focus on the cognition associated with critical thinking, that is, what is going on in the brain while critical thinking is taking place.
- Communications: Communications specialists focus on understanding and persuading in written and oral communications.
- Medicine: The medical community, especially the nursing profession, wants to ensure that medical practitioners have critical thinking capabilities to support their clinical work.
- Law: The legal profession has long believed that critical thinking ability is an important success factor in law school and in the practice of law.
- Intelligence: More recently, the intelligence community has identified critical thinking as a success factor for effective intelligence analysis.

Robert Sternberg provided an overview of the three primary academic fields where research and theory development regarding critical thinking provided the initial foundations for the concept:

> The study of critical thinking is of particular interest because of its confluence of three traditions of thought--the educational, the philosophical, and the psychological. Indeed, if there is a modern-day founder of the "critical-thinking movement," it is almost certainly John Dewey, who was simultaneously an educator, a philosopher, and a psychologist.[15]
>
> The Philosophical Tradition. The concern of philosophers with the elements of critical thinking dates back to Ancient time. If Dewey is the modern-day founder of the critical-

[15] Sternberg, R.J. *Critical Thinking: Its Nature, Measurement, and Improvement*, Yale University, New Haven, CT, 1986, p.4.

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> thinking movement, then Plato and Aristotle would be its ancient founders. In more recent times, philosophers such as Ennis (in press), Lipman (in press), and Paul (in press) have devoted their attention to understanding the bases of critical thinking. Philosophers have focused their attention not so much upon the requirements of critical thinking in the classroom, but upon the requirements of formal logical systems.[16]
>
> The Psychological Tradition. Psychologists interested in the nature of critical thinking, such as Bransford (1984), Bruner (1960, 1961), Feuerstein (1980), and Sternberg (1985), have been particularly concerned with characterizing critical thinking as it is performed under the limitations of the person and the environment.[17]
>
> The Educational Tradition. In the educational tradition of theorizing are leading figures such as Bloom (1955), Gagne (1965), Perkins (1981), and Renzulli (1976), whose theorizing seems directly responsive to the skills needed by children in the classroom for problem solving, decision making, and concept learning. Bloom's (1956) famous taxonomy of cognitive skills and Gagne's (1965) well-known hierarchy of learning skills have seen widespread application in classroom situations and even textbook creation.[18]

I will attempt to answer the question "What is critical thinking?" by examining several perspectives:

- The history and origin of the term *critical thinking*
- The many definitions of critical thinking
- The relationship of critical thinking to formal logic

Finally, this section concludes with a description of critical thinking synthesized from the research findings.

4.1.1. The Origin of the Term *Critical Thinking*

The true origin of the term *critical thinking* is not definitively known. Several scholars provided suggestions, but my research found earlier examples of the term than those mentioned. Several scholars also mentioned early influencers of the concept of critical thinking such as William Hare who wrote:

> The current obsession has created the impression that we have suddenly, and at long last, seen through the deficiencies of traditional education which have blinded us for so long to the insight we have now achieved. We have stumbled out of the cave into the daylight. If, however, critical thinking really is a central aim of education, it would be remarkable indeed if this were a discovery of the late twentieth century; having somehow eluded philosophers for more than 2000 years.
>
> In fact the history of this ideal can be traced back through philosophy to the earliest times. That account would include reference to Mill on keeping one's mind open to criticism, Kant on thinking for oneself, Descartes on the need to assess (not simply be acquainted with) the views of other philosophers, and on through the history of philosophy to its origins, in the western tradition at least, in the Socratic emphasis on the examined life.1 These ideas are central to any account of the intellectual virtues,

[16] Sternberg, p. 4.
[17] Sternberg, p. 5.
[18] Sternberg, p. 6.

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> including wisdom, judgment, and open-mindedness, and it is within this family of concepts that critical thinking emerges as an ideal.[19]

The concept of high quality thinking, described with many different names, was popular in the first half of the 20th century. Although the term *critical thinking* appeared in publications, it was initially just one of many terms used synonymously for good thinking. A list of the terms used to describe high quality thinking and some samples of where the terms were used include:

- Reflective thinking (John Dewey, *How We Think*[20])
- Critical thinking (Julius Boraas, *Teaching To Think*,[21] and Max Black, *Critical Thinking*[22])
- Straight thinking (E. L. Clarke, *The Art of Straight Thinking*[23] and Robert Thouless, *Straight and Crooked Thinking*[24])
- Effective thinking (J. Jastrow, *Effective Thinking*[25])
- Clear thinking (R. W. Jepson, *How to Think Clearly*[26])
- Correct thinking (C. H. Patterson, *Principles of Correct Thinking*[27])

The earliest use I found of the specific term *critical thinking* was in a book titled *Thinking and Learning to Think*, published in 1901. This book also used multiple terms to describe good thinking, including *clear thinking*, *distinct thinking*, *adequate thinking*, and *exhaustive thinking*.

> No one has done more to shape the critical thinking of the world than Kant;[28]

Although multiple authors identified John Dewey as the father of modern critical thinking, his preferred term was *reflective thinking* rather than *critical thinking*. Dewey's definition of *reflective thinking* is:

> Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends constitutes reflective thought.[29]

Dewey also described the qualitative aspects of thought that contribute to successful reflective thinking – the importance of being *critical* when thinking:

> There may, however, be a state of perplexity and also previous experience out of which suggestions emerge, and yet thinking need not be reflective. For the person may not be

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[19] Hare, W. "Critical Thinking as an Aim of Education," in *Aims of Education*, ed. R. Marples, Routledge, London, UK, 1999, p. 86.
[20] See Dewey, J. *How We Think*, D. C. Heath & Co., Chicago, IL, 1910 and Dewey, J. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process*, 2nd ed., Regnery, Chicago, IL, 1933.
[21] Boraas, J. *Teaching to Think*, Macmillan, New York, NY, 1922.
[22] Black, M. *Critical Thinking: An Introduction to Logic and Scientific Method*, 2nd ed., Prentice-Hall, New York, NY, 1952.
[23] Clarke, E.L. *The Art of Straight Thinking*, D. Appleton and Company, New York, NY, 1929.
[24] Thouless, R.H. *Straight and Crooked Thinking*, Pan Books Ltd., London, UK, 1953.
[25] Jastrow, J. *Effective Thinking*, World Publishing, Cleveland, OH, 1931.
[26] Jepson, R.W. *How to Think Clearly*, Longmans, Green and Company, New York, NY, 1936.
[27] Patterson, C.H. *Principles of Correct Thinking*, Longmans, Green and Co., New York, NY, 1937.
[28] Schaeffer, N.C. *Thinking and Learning to Think*, L. B. Lippincott Co., Philadelphia PA, 1901, p. 227.
[29] Dewey, J. *How We Think*, D. C. Heath & Co., Chicago, IL, 1910, p. 6 and Dewey, J. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process*, 2nd ed., Regnery, Chicago, IL, 1933, p. 9.

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> sufficiently *critical* about the ideas that occur to him. He may jump at a conclusion without weighing the grounds on which it rests; he may forego or unduly shorten the act of hunting, inquiring; he may take the first 'answer,' or solution, that comes to him because of mental sloth, torpor, impatience to get something settled. One can think reflectively only when one is willing to endure suspense and to undergo the trouble of searching. To many persons both suspense of judgment and intellectual search are disagreeable; they want to get them ended as soon as possible. They cultivate an over-positive and dogmatic habit of mind, or feel perhaps that a condition of doubt will be regarded as evidence of mental inferiority. It is at the point where examination and test enter into investigation that the difference between reflective thought and bad thinking comes in. To be genuinely thoughtful, we must be willing to sustain and protract that state, of doubt which is the stimulus to thorough inquiry, so as not to accept an idea or make positive assertion of a belief until justifying reasons have been found.[30]

Many definitions and descriptions of critical thinking use "reflective" or "reflective thinking" as a component in the definition. Some scholars also quote from Dewey's qualitative description of being sufficiently critical when thinking in their definitions of critical thinking.

Henry Hazlitt used a variety of modifiers for the word "thinking" in his 1916 book entitled *Thinking as a Science*, including *good thinking*, *methodic thinking*, *positive* and *constructive thinking*, *loose thinking*, *thinking with a purpose*, *uncritical thinking*, and *critical thinking*.[31] Although *critical thinking* was included in the book, the term does not appear to have had any special significance in 1916.

Teaching to Think by Julius Boraas, published in 1924, was the first book I found that had an explicit focus on the topic of critical thinking. The chapter called "The Development of Skill in Critical Thinking" explained the meaning of criticism and applied the concept of criticism to thinking.

> But why is it that the critical thinking of pupils, and of a large number of adults too, is so crude? According to the dictionary criticism is the "act or art of judging by some standard." Note that the dictionary calls it an "art."[32]

Boraas also provided a more detailed explanation of critical thinking:

> When all things have been considered, critical thinking is found to make three important demands: it insists on clearness. The critical thinker is always asking such questions as: Just what did we see? Just what were the sounds we heard? What were the exact words used? What did he really mean to say? What did he do? What did he mean to do? Critical thinking makes a persistent demand for all the actual facts of the case. It has no patience with merely alleged facts. It rebels against all reports which are "made to order" and "fixed" to suit the supposed needs of the hearer. Finally, critical thinking is effective thinking, it demands results. It is opposed to speculations which lead nowhere. It objects to everything that is irrelevant and immaterial. To some people critical thinking is merely the type of thinking that demands clearness and truth. It means more than that. It

[30] Dewey, p. 16.
[31] Hazlitt, H. *Thinking as a Science*, E. P. Dutton & Co., New York, NY, 1916.
[32] Boraas, J. *Teaching to Think*, Macmillan, New York, NY, 1922, p. 202.

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> insists that the particular truth which we hold be one that has value in reaching a conclusion.[33]

The first critical thinking assessment, now called the Watson-Glaser Critical Thinking Assessment (WGCTA), became available in an experimental form in 1938.[34]

The US Educational Policies Commission highlighted the importance of critical thinking, which they called *critical judgment*, in 1938.

> In other words, critical judgment is developed just as is the ability to play chess, or to read a book, or to solve problems in geometry; that is, by long and continuous practice under the criticism of someone qualified to evaluate the decisions. The child must learn the value of evidence. He must acquire a reverence for facts, must desire to find them, and must learn where they can most likely be secured. There are certain sources of facts, certain repositories of knowledge, that have been authenticated through the years. The student must learn what they are and acquire the technique of using them, and develop the habit of turning to them when called upon to solve problems. He must learn to defer judgment, to consider motives, to appraise evidence, to classify it, to array it on one side or the other of his question, and to use it in drawing conclusions. This is not the result of a special course of study, or of a particular part of the educative procedure; it results from every phase of learning and characterizes every step of thinking.[35]

By 1939 critical thinking as an educational ideal was sufficiently understood and considered important enough that the *New York Times* reported that Cornell University applied for and received a grant to study critical thinking in the classroom:

> This Fall Cornell University, aided by an $18,000 grant from the General Education Board, is starting a three-year experiment to discover whether a capacity for critical thinking about social problems can be developed in high school pupils.[36]

At the beginning of the 20th Century, *critical thinking* was just one of many terms used for good thinking. By the end of the century it was the only term related to thinking that was listed as part of the National Educational Goals:

> The proportion of college graduates who demonstrate an advanced ability to think critically, communicate effectively, and solve problems will increase substantially.[37]

The growth of critical thinking as the primary term referring to good thinking can also be demonstrated by using the Google search capability known as the Ngram Viewer. The Ngram Viewer searches for specific terms in a corpus of books for a specified period of time to determine the usage of the terms.[38] In order to create the Ngram view shown in Figure 1, I used

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[33] Boraas, p. 215.
[34] Glaser, E.M. *An Experiment in the Development of Critical Thinking*, AMS Press Inc., New York, NY, 1941, p. 87.
[35] Educational Policies Commission. *The Purposes of Education in American Democracy*, National Educational Association of the United States, Washington, D.C., 1938, p. 35.
[36] Anonymous. "Cornell Plans Test of Pupil-Thinking," *New York Times*, 1939, September 17, pp. 57.
[37] "Panel Goal 6: Adult Literacy and Lifelong Learning," National Education Goals Panel. Available: http://govinfo.library.unt.edu/negp/page3-13.htm, Viewed: March 17, 2011.
[38] Google Books Ngram Viewer, Google Inc. Available: http://books.google.com/ngrams/graph?content=straight+thinking%2Creflective+thinking%2Ccritical+thinking%2Cclear+thinking%2Csound+thinking&year_start=1900&year_end=2010&corpus=0&smoothing=3 Viewed: February 8, 2012. See also:

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the terms clear thinking, straight thinking, critical thinking, sound thinking, and reflective thinking.

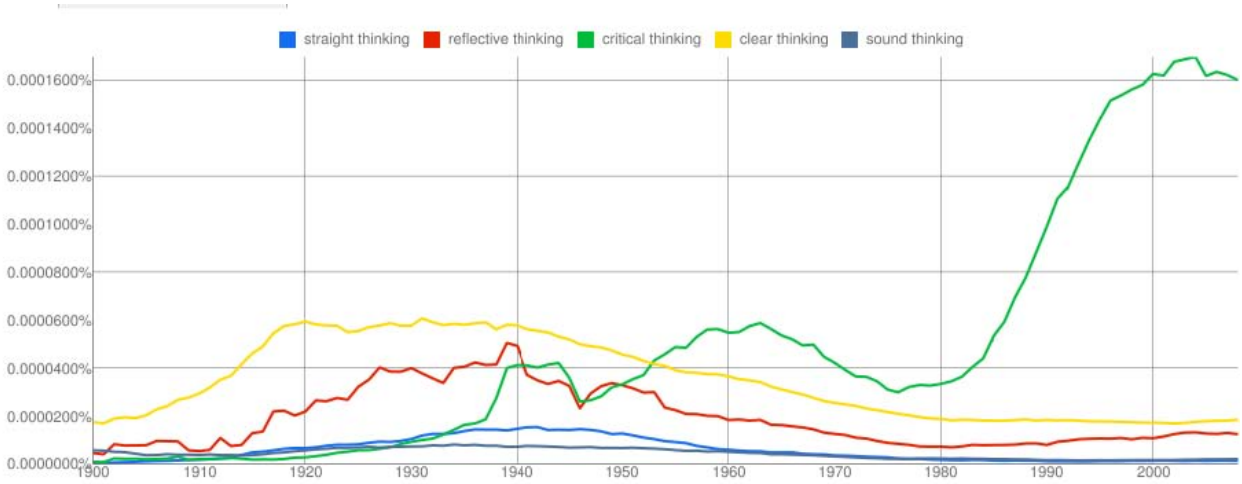

Figure 1: Usage of Terms Related to Good Thinking

As the Ngram view shows, in the 1920s: *critical thinking* was the least used term; it became the dominant term by the 1960s and has been used even more frequently from about 1980 to the present. It is not clear from the literature I reviewed what caused *critical thinking* to become the dominant term used to describe "good thinking."

4.1.2. Defining Critical Thinking

I started my research by trying to find a definition of critical thinking in order to understand exactly what critical thinking is. However, a single, universally accepted definition of critical thinking does not exist. Sufficient differences existed in the meaning of the term as early as 1987 that Barry Beyer commented:

> The term critical thinking is one of the most abused terms in our thinking skills vocabulary. Generally it means whatever its users stipulate it to mean. In some circles the term *critical thinking* is used to mean all thinking operations, from decision making to analysis of part-whole relationships to interpreting. In other circles it means the skills drawn from Bloom's taxonomy. Yet critical thinking is *not* to be considered as encompassing all, or identical to any, of these operations. Critical thinking, for example, is obviously not the same as recall. Neither is critical thinking synonymous with decision making or problem solving.[39]

The recognition that a universally accepted definition of critical thinking does not exist continues to the present time. Condon and Kelly-Riley described the problem this way:

> The current literature on critical thinking is rife with conflict and competing ideologies.[40]

Jean-Baptiste Michel*, Yuan Kui Shen, Aviva Presser Aiden, Adrian Veres, Matthew K. Gray, William Brockman, The Google Books Team, Joseph P. Pickett, Dale Hoiberg, Dan Clancy, Peter Norvig, Jon Orwant, Steven Pinker, Martin A. Nowak, and Erez Lieberman Aiden*. *Quantitative Analysis of Culture Using Millions of Digitized Books*. **Science** (Published online ahead of print: 12/16/2010)

[39] Beyer, B.K. *Practical Strategies for the Teaching of Thinking*, Allyn and Bacon, Boston, MA, 1987, p. 32.

[40] Condon, W. & Kelly-Riley, D. "Assessing and Teaching What We Value: The Relationship between College-Level Writing and Critical Thinking Abilities," *Assessing Writing*, Vol. 9, No. 1, 2004, p. 64.

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My research confirmed the conflict and competing ideologies. I retrieved 106 documents that contained at least one definition of critical thinking, and many contained multiple definitions. I found 219 definitions, including many duplicates, in the documents I reviewed. I identified 118 unique definitions.[41]

The high number of duplicate definitions was primarily due to the following:

- Many documents began with a list of definitions the author found. The author then discussed which definition was preferred or why all definitions were inadequate and a new definition was needed.
- The originator of a definition wrote multiple books or articles, each referencing his or her preferred definition.
- Some authors adopted one of the extant definitions and used this definition in one or more documents.

Several factors contributed to the high number of unique definitions:

- Although a few scholars have referred to and used definitions provided by others, most critical thinking scholars developed their own unique definitions as part of their scholarly work. Some, such as Richard Paul with the Foundation for Critical Thinking, developed multiple definitions, further confusing the issue.
- Research and scholarship on critical thinking has been conducted in multiple academic fields. Each of these fields has its own approach to the topic, its own lens through which to view critical thinking, and its own intended application of thinking critically. A definition, such as Sternberg's, from the cognitive psychology tradition is different than a definition from the educational tradition, such as Ennis'.
- Many entities with an interest in applying critical thinking developed their own definition after reviewing the multitude of definitions available. Examples include Baker University,[42] South Carolina,[43] the nursing profession,[44] and the intelligence community.[45]

An example of the challenge that exists in reaching agreement on a definition comes from the 1990 American Philosophical Association (APA) study of critical thinking.[46] One outcome of this study was a definition of critical thinking. Yet even though 47 scholars from multiple fields agreed to what has been called the "APA consensus definition of critical thinking," the only

[41] See Appendix A for a complete list of the definitions I retrieved during my research.
[42] Hatcher, D.L. *Critical Thinking and the Liberal Arts,* Baker University, Baldwin City, KS, 1990; Hatcher, D.L. *Critical Thinking: A New Definition and Defense*, Baker University, Baldwin City, KS, 2000.
[43] Cook, P., Johnson, R., Moore, P., Myers, P., Pauly, S., Pendarvis, F., Prus, J. & Ulmer-Sottong, L. *Critical Thinking Assessment: Measuring a Moving Target. Report & Recommendations of the South Carolina Higher Education Assessment Network Critical Thinking Task Force,* South Carolina Higher Education Assessment Network, Rock Hill, SC, 1996.
[44] Staib, S. "Teaching and Measuring Critical Thinking," *Journal of Nursing Education,* Vol. 42, No. 11, 2003, pp. 498-508.
[45] For example Hendrickson, N. "Critical Thinking in Intelligence Analysis," *International Journal of Intelligence and Counterintelligence,* Vol. 21, No. 4, 2008, pp. 679-693.
[46] Facione, P.A. *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research Findings and Recommendations.* American Philosophical Association, Newark, DE, 1990.

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participant who continues to use the consensus definition is the facilitator of the process, Peter Facione.

The definitions I identified varied widely in their understandability and their practicality. Some were simplistic; others were overly complex. In the search for *practical* definitions or descriptions, that is, those that enable the reader or practitioner to understand what distinguishes critical thinking from non-critical thinking, I found two approaches. Critical thinking has been perceived as a noun – a thing to be defined or described. A more informative explanation came from those who also described the activity of thinking critically – the act of thinking with the qualitative descriptor *critical* applied to it as Dewey described.

Despite the differences in definitions, commonalities do exist between definitions. The most common themes that appeared in the definitions and descriptions include:

- Deliberate/intentional/active approach to thinking
- Systematic in thinking; focused; disciplined, skilled
- Persistent, not giving up too soon
- Focus on objectivity, remaining open to what the evidence tells you
- Interpretation of information
- Evaluation of all information
- Synthesis of valid information
- Analysis of information
- Inference, judgment, reaching a conclusion that can be justified

Some definitions also include the following:

- Explanation of results and evidence used to reach results
- Assessment of assumptions
- Formal logic
- Skepticism
- Creativity
- Reflection
- Use of intellectual standards or criteria
- Metacognition – thinking about one's thinking

I chose a sample of definitions for inclusion in this report to illustrate the diversity of perspectives in defining critical thinking. The samples reflect two categories:

1. Scholarly definitions written by those who are primarily focused on academic research and theories
2. Applied definitions written by those who are attempting to actually *think critically*, including those in the intelligence analysis literature

Scholarly Definitions: Edward Glaser was the source of the earliest formal definition of critical thinking that I was able to locate. In 1941, Glaser, a professor of education at Columbia

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University and co-author of the Watson-Glaser Critical Thinking Test,[47] wrote about his research in teaching students to think critically. His definition of critical thinking is:

> The ability to think critically, as conceived in this volume, involves three things: (1) an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experiences, (2) knowledge of the methods of logical inquiry and reasoning, and (3) some skill in applying those methods.[48]

Glaser's definition includes three themes that recur in the literature:

- The importance of the disposition to think critically because skills are insufficient without a critical attitude.
- The importance of skills in successfully thinking critically.
- The role of logic in critical thinking.

Glaser continued immediately with an explanation of how to think critically. He quoted directly from Dewey's definition of reflective thinking, thus linking the critical thinking tradition formally with Dewey's reflective thinking. Glaser's description clarifies the act of thinking critically far beyond Dewey's definition:

> Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends. It also generally requires ability to recognize problems, to find workable means for meeting those problems, to gather and marshal pertinent information, to recognize unstated assumptions and values, to comprehend and use language with accuracy, clarity, and discrimination, to interpret data, to appraise evidence and evaluate arguments, to recognize the existence (or non-existence) of logical relationships between propositions, to draw warranted conclusions and generalizations, to put to test the conclusions and generalizations at which one arrives, to reconstruct one's patterns of beliefs on the basis of wider experience, and to render accurate judgments about specific things and qualities in everyday life.[49]

Glaser's definition was directly referenced in three other documents.

Although many scholars noted the importance of Glaser's work, authors did not quote his definition frequently. Instead, the most commonly cited scholarly definitions of critical thinking came from three sources:

- The work of philosopher and educator Robert Ennis
- The work of the APA expert panel which resulted in the APA consensus definition of critical thinking
- The Foundation for Critical Thinking

[47] Watson, G. & Glaser, E.M. *Watson-Glaser II Critical Thinking Appraisal Technical Manual and User's Guide*, NCS Pearson, Inc., San Antonio, TX, 2009.
[48] Glaser, E.M. *An Experiment in the Development of Critical Thinking*, AMS Press Inc., New York, NY, 1941, p. 5.
[49] Glaser, E.M. *An Experiment in the Development of Critical Thinking*, AMS Press Inc., New York, NY, 1941, pp. 5-6.

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Robert Ennis, author of the Cornell Critical Thinking Test[50] and the Ennis Weir Critical Thinking Essay Test,[51] has written extensively about critical thinking. He developed two definitions, the first of which was proposed in 1962.

> As a root notion critical thinking is taken to be the correct assessing of statements.[52]

Ennis explained the evolution of his thinking in 1993:

> A definition of critical thinking that I at one time endorsed is that critical thinking is the correct assessing of statements (Ennis, 1962). If I had not elaborated this definition, it would be as vague as Bloom's taxonomy. But even when elaborated, it suffers from excluding creative aspects of critical thinking, such as conceiving of alternatives, formulating hypotheses and definitions, and developing plans for experiments. I now think the contemporary conception of critical thinking includes these things, so the "correct assessing" definition is more narrow than standard usage, and thus could interfere with communication among proponents of critical thinking.
>
> The following definition seems to be more in accord with contemporary usage and thus, I hope, will minimize confusion in communication: "Critical thinking is reasonable reflective thinking focused on deciding what to believe or do."[53]

Ennis took advantage of Dewey's concept of reflective thinking for his current definition, continuing the connection with Dewey. The original Ennis definition was included in nine documents, four of which were authored by Ennis. Ennis' current definition (sometimes with slight variations such as "Critical thinking was characterized as a self-adjusting process of judging what to believe or what to do in a given context.") was included in 23 documents, six of which were authored by Ennis.

In 1990 Peter Facione led an effort under the auspices of the American Philosophical Association that made a systematic inquiry into the current state of critical thinking and thinking assessment. Facione solicited opinions from major researchers in the realm of critical thinking in universities across the US. The researchers represented a broad range of disciplines including philosophy, psychology, education, social sciences, computer science, and physics. Early in the effort the participants realized they needed to focus on clarifying what is meant by the term *critical thinking*.

> A clear and accurate conceptualization of CT is absolutely essential for the development of valid CT assessment tools and effective CT instructional programs. With this in mind, and recognizing that divergent conceptualizations of CT have hindered curricular and assessment efforts, early in the Delphi process the panel decided its most worthwhile contribution could be the articulation of a clear and correct conceptualization of CT. The expert panelists devoted their major effort toward that end.[54]

The expert panelists reached a consensus on the conceptualization of critical thinking:

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[50] Ennis, R.H., Millman, J. & Tomko, T.N. *Cornell Critical Thinking Tests Level X & Level Z Manual*, 5th ed., The Critical Thinking Co., Seaside, CA, 2005.
[51] Ennis, R.H. & Weir, E. *The Ennis-Weir Critical Thinking Essay Test*, Midwest Publications, Pacific Grove CA, 1985.
[52] Ennis, R.H. "A Concept of Critical Thinking," *Harvard Educational Review*, Vol. 32, No. 1, 1962, p. 83.
[53] Ennis, R.H. "Critical Thinking Assessment," *Theory into Practice*, Vol. 32, No. 3, 1993, pp. 179-180.
[54] Facione, P.A. *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research Findings and Recommendations.* American Philosophical Association, Newark, DE, 1990, pp. 8-9.

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> We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life.[55]

After providing a definition, the panel then described thinking critically:

> While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society.[56]

The definition and description that resulted from this effort continued Glaser's focus on thinking skills and dispositions as important factors in critical thinking, but were not otherwise linked to earlier definitions.

It is interesting to note that while Facione has embraced this definition and used it as the basis for the California Critical Thinking Skills Tests[57] (CCTST) and the California Critical Thinking Dispositions Inventory)[58] (CCTDI) many of the participants in the APA study continue to use their own definitions or conceptualizations of critical thinking rather than using the APA consensus definition. For example, Robert Ennis continues to use his definition of "reasonable reflective thinking focused on deciding what to believe or do." Another APA participant, Richard Paul is the author or supporter of the many definitions proposed by the Foundation for Critical Thinking, which I discuss in the next set of definitions.

The APA consensus definition was referenced in 10 documents, four of which were authored by Facione.

The organization that is known today as the Foundation for Critical Thinking was established in 1980 as the Center for Critical Thinking. The Center is now part of the Critical Thinking Community consisting of the Foundation for Critical Thinking, the Center for Critical Thinking, the National Council for Excellence in Critical Thinking, and the International Center for the Assessment of Higher Order Thinking. When I searched for *critical thinking* using common search engines, the Foundation for Critical Thinking is one of the first sites returned and is therefore likely to be one of the first organizations to be consulted about critical thinking.

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[55] Facione, p. 3.
[56] Facione, p.3.
[57] "California Critical Thinking Skills Tests," Insight Assessment. Available: http://www.insightassessment.com/, Viewed: April 29, 2010.
[58] "California Critical Thinking Disposition Inventory: Scale Descriptions," Insight Assessment. Available: http://www.insightassessment.com/Scales%20CCTDI.html, Viewed: October 9, 2009.

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The Foundation has provided annual conferences and workshops on critical thinking since 1980, published numerous reports, and published a series of miniature guides to various aspects of critical thinking. The Foundation cites at least eight different definitions of critical thinking in its publications and on its web site, several of which have been widely quoted. The primary authors of Foundation definitions, when an author is noted, are Richard Paul, Linda Elder, and Michael Scriven.

The most widely quoted and paraphrased of the Foundation's definitions is one of the least useful found in the entire critical thinking literature. It owes nothing to any previous tradition in critical or reflective thinking definitions:

> Critical thinking is the art of analyzing and evaluating thinking with a view to improving it.[59]

This definition, or a variation of it such as "Thinking about our thinking while we're thinking in order to make our thinking better," was included in 12 documents. Three of these documents were authored by a member of the Foundation.

The second most widely quoted definition from the Foundation is more practical and is linked to both Ennis' current definition and to the APA consensus definition.

> Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.[60]

This definition was included in ten documents, two of which were authored by a member of the Foundation.

Although the definitions just described are the most commonly quoted in the literature, an examination of the definitions of critical thinking from different academic disciplines is useful for illustrating how diverse scholarly perspectives are.

Robert Sternberg provided a psychologically-based definition in his 1986 report, *Critical Thinking: Its Nature, Measurement, and Improvement*. Sternberg's definition can be described as a process-oriented definition. It is not linked to any of the earlier definitions and provides no hint of how to think critically.

> Construed broadly, critical thinking comprises the mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts.[61]

Sternberg's definition was quoted in one other document.

Diane Halpern provided another psychologically-based definition:

> Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed - the kind of thinking involved in solving problems,

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[59] Paul, R. & Elder, L. *The Miniature Guide to Critical Thinking Concepts and Tools*, Foundation for Critical Thinking, Dillon Beach, CA, 2007, p. 4.

[60] Scriven, M. & Paul, R. "Defining Critical Thinking," Foundation for Critical Thinking. Available: http://www.criticalthinking.org/page.cfm?PageID=410&CategoryID=51, Viewed: March 16, 2010.

[61] Sternberg, R.J. *Critical Thinking: Its Nature, Measurement, and Improvement*, Yale University, New Haven, CT, 1986 , p. 1.

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> formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task.[62]

Halpern's definition was quoted in six other documents.

Educator Joanne Kurfiss wrote a report on critical thinking for the Association for the Study of Higher Education. She provided a practical definition of critical thinking and followed it immediately with a description of thinking critically.

> Critical thinking is a rational response to questions that cannot be answered definitively and for which all the relevant information may not be available. It is defined here as an investigation whose purpose is to explore a situation, phenomenon, question, or problem to arrive at a hypothesis or conclusion about it that integrates all available information and that can therefore be convincingly justified.
>
> In critical thinking, all assumptions are open to question, divergent views are aggressively sought, and the inquiry is not biased in favor of a particular outcome.
>
> The outcomes of a critical inquiry are twofold: a **conclusion** (or hypothesis) and the **justification** offered in support of it. These outcomes are usually set forth in the form of an **argument**, defined as "the sequence of interlinked claims and reasons that, between them, establish the content and force of the position for which a particular speaker is arguing" (Toulmin, Rieke, and Janik 1979, p. 13). The need for justification arises from the ill-defined nature of problems to which the term "critical thinking" generally applies. Because conclusions cannot be tested (as they can be in problem solving), the arguer must demonstrate their plausibility by offering supporting reasons (Voss, Tyler, and Yengo 1983).[63]

Kurfiss' definition was quoted in one other document.

Philosophers Alex Fisher and Michael Scriven provided a definition in their 1997 critical thinking textbook. This definition was followed by over 20 pages of text explaining each term in the definition.

> Critical thinking is skilled, active interpretation and evaluation of observations, communications, information, and argumentation.[64]

This definition was quoted in a later book written by Fisher.

Brooke Moore and Richard Parker also included a philosophy-based definition in their critical thinking textbook. Note that their definition specifically excludes inference, an important component of critical thinking that appears in other descriptions and is an essential aspect of intelligence analysis.

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[62] Halpern, D.F. *Thought and Knowledge: An Introduction to Critical Thinking*, Lawrence Erlbaum Associates, Mahwah, NJ, 2003, p. 6.
[63] Kurfiss, J.G. *Critical Thinking: Theory, Research, Practice, and Possibilities*, ASHE-ERIC Higher Education Report No. 2, Association for the Study of Higher Education, Washington, D.C., 1988, p. 2.
[64] Fisher, A. & Scriven, M. *Critical Thinking: Its Definition and Assessment*, Edgepress, Point Reyes, CA, 1997, p. 20.

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> But, boiled down, critical thinking is the careful application of reason in the determination of whether a claim is true. Notice that it isn't so much coming up with claims, true or otherwise, that constitutes critical thinking; it's the evaluation of claims, however we come up with them.[65]
>
> THE BASICS: CLAIMS, ISSUES, AND ARGUMENTS
>
> In the next few pages, we'll introduce the basic building blocks of critical thinking: claims, issues, and arguments. Identifying these elements, including separating them out from embellishments and impostors, and analyzing and evaluating them are what critical thinking is all about.[66]

No other documents referenced this specific definition.

It should be noted that regardless of discipline, each author of a scholarly definition, both those discussed here and those included in Appendix A, stated that his or her definition is the correct definition.

Applied Definitions: Individuals who intend to apply critical thinking in their work are faced with a dilemma: how to determine which, of the many definitions of critical thinking that exist, is the correct definition? Which definition should be used as the basis for the application of critical thinking in their work? Depending on how extensive their research was before making a decision, they may have found anywhere from a few definitions to over one hundred as we found in this search. Rather than choosing an existing definition, many of the organizations considering the application of critical thinking opted to just develop their own definition.

The next three examples illustrate the varying approaches taken when an organization opts to develop its own critical thinking definition. An organization might:

- combine multiple definitions into one new definition
- reject the existing definitions to develop an entirely new definition
- conduct a Delphi study similar to the APA study discussed earlier in order to develop a new definition

In addition to providing examples of the above approaches, this section of the report also presents a sample of the applied definitions developed for intelligence analysis.

Patricia Cook et al. provided a combined definition adapted from those of Beyer, Facione, McPeck, Sternberg, and Ennis in a report for the South Carolina Higher Education Assessment network. This definition consists of terms used by the referenced scholars assembled into one statement.

> Critical thinking is a reflective, systematic, rational, and skeptical use of cognitive representations, processes, and strategies about beliefs, problems, and/or courses of action.[67]

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[65] Moore, B.N. & Parker, R. *Critical Thinking*, 9th ed., McGraw-Hill, Boston, MA, 2009, p. 3.
[66] Moore & Parker, p. 5.
[67] Cook, P., Johnson, R., Moore, P., Myers, P., Pauly, S., Pendarvis, F., Prus, J. & Ulmer-Sottong, L. *Critical Thinking Assessment: Measuring a Moving Target. Report & Recommendations of the South Carolina Higher Education Assessment Network Critical Thinking Task Force,* South Carolina Higher Education Assessment Network, Rock Hill, SC, 1996, p. 6.

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Donald Hatcher, leader of a critical thinking project at Baker University, developed a new definition after deeming the existing scholarly definitions inadequate. His recommended definition is very similar to Kurfiss' definition and is related to Dewey's description of critical reflection. It is focused on outcome rather than skill or process:

> Critical thinking is thinking that attempts to arrive at a judgment only after honestly evaluating alternatives with respect to available evidence and arguments.[68]

In 2000, members of the nursing profession used a Delphi study to develop a nursing-specific definition of critical thinking. This definition is more focused on dispositions and skills than on outcomes.

> Critical thinking is an essential component of professional accountability and quality nursing care. Critical thinkers in nursing exhibit these habits of the mind: confidence, contextual perspective, creativity, flexibility, inquisitiveness, intellectual integrity, intuition, open-mindedness, perseverance, and reflection. Critical thinkers in nursing practice the cognitive skills of analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting and transforming knowledge.[69]

Within the intelligence analysis literature, 21 documents contained definitions for critical thinking in intelligence analysis, with a total of 27 definitions and 13 uniquely new definitions. Several of the documents included multiple definitions, and seven of the 21 documents referencing scholarly definitions from the APA, Halpern, and the Foundation for Critical Thinking.

A sample of the intelligence analysis definitions follows. The first two definitions share common themes with each other and with the scholarly definitions. The third definition represents a new understanding of critical thinking.

Edward Waltz provided a definition in *Knowledge Management in the Intelligence Enterprise*:

> Critical thinking is based on the application of a systematic method to guide the collection of evidence, reason from evidence to argument, and apply objective decision-making judgment (Table 4.10). The systematic methodology assures completeness (breadth of consideration), objectivity (freedom from bias in sources, evidence, reasoning, or judgment), consistency (repeatability over a wide range of problems), and rationality (consistency with logic). In addition, critical thinking methodology requires the explicit articulation of the reasoning process to allow review and critique by others.[70]

The training course, *Analysis 101*, referenced several definitions before providing its own:

> Critical thinking is quality control for problem solving and reasoning. Critical thinking enables you to judge the accuracy and relevance of your information, categorize information as assumption, fact, or inference, identify gaps in your knowledge, recognize factors that influence your objectivity and the objectivity of others, and judge the validity of your arguments.[71]

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[68] Hatcher, D.L. *Critical Thinking: A New Definition and Defense*, Baker University, Baldwin City, KS, 2000, p. 3.
[69] Staib, S. "Teaching and Measuring Critical Thinking," *Journal of Nursing Education*, Vol. 42, No. 11, 2003, p. 499.
[70] Waltz, E. *Knowledge Management in the Intelligence Enterprise*, Artech House, Boston, MA, 2003, p. 144.
[71] Anonymous. *Analysis 101. Participant Guide* 2008, p. 11.

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Intelligence Community Directive (ICD) Number 610 contains the competency directories for the IC workforce. One competency defined for individual contributors and for supervisors is critical thinking . The critical thinking definition and explanation in Table 1 comes from the list of competencies for non-supervisory IC employees at GS-15 and below. [72]

Table 1: ICD 610 - Critical Thinking Competencies for Non-Supervisory Personnel

Critical Thinking	IC employees are expected to use logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to effectively inform decisions and outcomes.
Creative Thinking	Develops new insights into situations and applies innovative solutions to problems and to improve processes. Designs new methods and tools where established methods and procedures are inapplicable, unavailable, or ineffective.
Exploring Alternatives	Seeks out, evaluates, and integrates a variety of perspectives. Seeks to increase own and others' understanding of an issue based on new information and alternative perspectives. Listens to and shows appreciation for alternative ideas and approaches.
Enterprise Perspective	Understands the interrelationships among organizations and components of the IC. Understands how one's own work impacts, and is impacted by, the mission and operations of IC organizations and components, and uses this information to maximize contribution to mission accomplishment.
Situational Awareness	Maintains awareness of changing conditions, current events, and cultural and historical contexts as they affect one's own work.
Synthesis	Identifies and uses principles, rules, and relationships to construct arguments or interpret facts, data, or other information. Dissects problems into meaningful parts and uses logic and judgment to determine accuracy and relevance of data. Identifies and reconciles gaps, uncertainties, and key assumptions of data. Integrates evidence/information, evaluates and prioritizes alternatives, and assesses similarities and differences in data to develop findings and conclusions. Understands potential implications of these findings or conclusions.

Three documents referenced the definition for individual contributors.

The critical thinking definition and description in Table 2 is excerpted from the core competencies for supervisory and managerial IC employees at GS-15 and below. [73]

[72] Office of the Director of National Intelligence. *Intelligence Community Directive Number 610. Competency Directories for the Intelligence Community Workforce.* 2008, p. B-2.
[73] Office of the Director of National Intelligence, pp. C-1 – C-2.

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Table 2: ICD 610 -Critical Thinking Competencies for Supervisory and Managerial Personnel

Critical Thinking	IC employees are expected to use logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to effectively inform decisions and outcomes. In addition, IC supervisors are expected to establish a work environment where employees feel free to engage in open, candid exchanges of information and diverse points of view.
Decisiveness	Identifies and understands issues, problems, and opportunities. Compares data from different sources throughout the IC and external agencies to draw conclusions. Chooses an approach, develops solutions, and takes action consistent with IC values, available facts, constraints, and probable consequences. Makes appropriate decisions in a timely manner even when data are limited or solutions produce unpleasant consequences.
Flexibility	Is open to change and new information; rapidly adapts to new information, changing conditions, or unexpected obstacles.
Problem Solving	Identifies and analyzes problems; weighs relevance and accuracy of information; generates and evaluates alternative solutions; and makes recommendations.

According to ICD 610, senior officers do not have a critical thinking competency expectation, although systems thinking and strategic thinking are identified as required sub-skills.

The many definitions reviewed in order to produce this report illustrate one of the primary findings of this study. Both inside and outside the intelligence community, a common definition of critical thinking does not exist. The wide variations in the understandability of the definitions and the range of cognitive skills and activities described make it difficult to apply the concepts in order to *think critically* . For example:

- Just what is "reasonable reflective thinking" as defined by Ennis?
- How can someone "think about his thinking while he is thinking in order to make his thinking better" as described by the Foundation for Critical Thinking?
- What are the "cognitive skills or strategies that increase the probability of a desirable outcome" as described by Kuhn?
- How important is inference in critical thinking?
- What is the contribution of creativity to thinking critically?

4.1.3. Critical Thinking and Logic

Another factor contributing to the confusion surrounding critical thinking is its relationship to philosophy and logic. Critical thinking is sometimes perceived as being the same as formal logic.[74] One result of this perception is that many universities satisfy critical thinking requirements through philosophy courses. However, logic alone does not enable an individual to become an adept critical thinker. For example, consider that both of the philosophy-based definitions discussed earlier in this report *exclude* the concept of inference, often considered an important component of critical thinking.

[74] For example, see Glaser's definition in the definitions section of this report which says one element of critical thinking is knowledge of logical inquiry.

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Max Black provided an outstanding example of the perception that critical thinking equals logic in his book *Critical Thinking*. The book's subtitle is "An Introduction to Logic and Scientific Method." Although the book is titled *Critical Thinking*, Black uses the term critical thinking only four times in the text. Rather, Black wrote the following about logic:

> LOGIC can be briefly defined as the study of reasoning. The study of any subject calls for thought, and every student is, or ought to be, a thinker; but he is not a student of logic unless he thinks about reasoning. Now reasoning is itself a special kind of thinking; hence the special kind of study known as logic is concerned with thinking about thinking.[75]

Black linked the study of logic to the concept of critical evaluation:

> Logic may be thought of as the *art* of improving reasoning, and the *science* of the conditions to which this art must conform; it therefore serves the practical interest of self-betterment and the theoretical interest of understanding. Logic aims at the cultivation of the art and science of the *criticism* of reasoning." Criticism" is intended to mean here the exhibition of *standards* and *principles.* The logician pursues certain ideals, and wishes to understand the objective conditions that have to be satisfied if those ideals are to be attained.[76]

In 2009, Brooke Noel Moore and Richard Parker published the ninth edition of their book, *Critical Thinking*.[77] As with Black's book, this textbook, intended for a critical thinking class, is primarily focused on logic, with a strong emphasis on syllogisms, fallacies, and determining the validity of arguments.

In contrast to many philosophers, others believe that logic is insufficient for an understanding of and an ability to apply critical thinking. For example, John McPeck took a very strong stand against logic as a means to thinking critically:

> In the present chapter I shall attempt to show why courses in logic fail to accomplish the goal of developing critical thinkers and how the epistemology of various subjects would be the most reasonable route to that end. Ironically, as it turns out, the epistemological approach to critical thinking involves little more than providing what has always been a necessary condition of education, namely, understanding what constitutes good reasons for various beliefs. In short, there is both a conceptual and a pedagogic link between epistemology, critical thinking and education, but the study of logic or critical thinking as such has no part in this linkage.[78]

David Schum and Francis Hume discussed critical reasoning within the context of intelligence analysis in *The Art and Science of The Process of Intelligence Analysis* and stated that logic is not sufficient for the kinds of tasks an analyst must perform.

> The truth is that analysts are routinely asked to perform tasks for which they have received little if any adequate tutoring. Conventional courses in logic, probability, and statistics do not prepare a person for the task of drawing conclusions based on masses of

[75] Black, M. *Critical Thinking: An Introduction to Logic and Scientific Method*, 2nd ed., Prentice-Hall, New York, NY, 1952, p. 3.
[76] Black, pp. 9-10.
[77] Moore, B.N. & Parker, R. *Critical Thinking*, 9th ed., McGraw-Hill, Boston, MA, 2009.
[78] McPeck, J.E. *Critical Thinking and Education*, St. Martin's Press, New York, NY, 1981, p. 22.

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evidence whose items suggest many, often complex and interrelated, lines of arguments on hypotheses of interest.[79]

Claudia María Álvarez Ortiz conducted a meta-analysis of studies to determine whether the study of philosophy improves critical thinking abilities.

In brief, the key findings of the meta-analysis are as follows:

- First, there is insufficient evidence to be confident that studying philosophy improves critical thinking skills any more than studying other academic disciplines.
- Second, the results indicate that studying philosophy appears to be less effective than studying critical thinking in its own right. [80]

If we don't have a clear, shared definition of critical thinking and some authors argue that critical thinking is more than logic, what is it?

4.1.4. Summary: What is Critical Thinking?

Everyone thinks every day, but what distinguishes critical from non-critical thinking? After reviewing over 500 documents about critical thinking I have concluded that the term *critical thinking* represents a concept that describes a special quality of thinking. Dewey's description of critical and non-critical reflection helps clarify the special quality of thinking we now call *critical thinking*:

> For the person may not be sufficiently *critical* about the ideas that occur to him. He may jump at a conclusion without weighing the grounds on which it rests; he may forego or unduly shorten the act of hunting, inquiring; he may take the first 'answer,' or solution, that comes to him because of mental sloth, torpor, impatience to get something settled. One can think reflectively only when one is willing to endure suspense and to undergo the trouble of searching. Too many persons both suspense of judgment and intellectual search are disagreeable; they want to get them ended as soon as possible. They cultivate an over-positive and dogmatic habit of mind, or feel perhaps that a condition of doubt will be regarded as evidence of mental inferiority. It is at the point where examination and test enter into investigation that the difference between reflective thought and bad thinking comes in. To be genuinely thoughtful, we must be willing to sustain and protract that state, of doubt which is the stimulus to thorough inquiry, so as not to accept an idea or make positive assertion of a belief until justifying reasons have been found.[81]

Critical thinking refers to *how* one approaches the thinking task as well as what activities and skills one employs. It describes the act of thinking *critically*, thinking with a critical attitude, thinking that approaches thinking tasks deliberately, thoroughly, objectively, holistically, and systematically. Activities and traits such as those listed in Figure 2 are *hows* that might be especially useful in contributing to the quality of thinking called critical thinking. This description includes cognitive skills in order to clarify the kinds of cognitive activities needed in critical thinking. It also includes descriptions of attitudes that contribute to the critical quality of thinking.

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[79] Hughes, F.J. & Schum, D.A. *The Art and Science of the Process of Intelligence Analysis*, Joint Military Intelligence College, Washington, D.C., 2003, p. 2.
[80] Ortiz, C.M.A. *Does Philosophy Improve Critical Thinking Skills?* MA Thesis, University of Melbourne, 2007, p. 3.
[81] Dewey, J. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process*, 2nd ed., Regnery, Chicago, IL, 1933, p. 16.

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This description of critical thinking is most closely linked to the definition provided by Kurfiss.[82] The list of cognitive skills is most closely linked to those included in the definitions from the Foundation of Critical Thinking,[83] the APA Consensus definition,[84] the description of thinking critically provided by Glaser,[85] and the description of critical judgment provided by the US Educational Policies Commission.[86] The list of character traits is most closely linked with the descriptions provided by Dewey,[87] the APA Consensus Definition,[88] and Glaser.[89]

[82] Kurfiss, J.G. *Critical Thinking: Theory, Research, Practice, and Possibilities,* ASHE-ERIC Higher Education Report No. 2, Association for the Study of Higher Education, Washington, D.C., 1988, p. 2.
[83] Scriven, M. & Paul, R. "Defining Critical Thinking," Foundation for Critical Thinking. Available: http://www.criticalthinking.org/page.cfm?PageID=410&CategoryID=51, Viewed: March 16, 2010.
[84] Facione, P.A. *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research Findings and Recommendations.* American Philosophical Association, Newark, DE, 1990, p. 3.
[85] Glaser, E.M. *An Experiment in the Development of Critical Thinking,* AMS Press Inc., New York, NY, 1941, pp. 5-6.
[86] Educational Policies Commission. *The Purposes of Education in American Democracy,* National Educational Association of the United States, Washington, D.C., 1938, p. 35.
[87] Dewey, J. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process,* 2nd ed., Regnery, Chicago, IL, 1933, p. 16.
[88] Facione, P.A. *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research Findings and Recommendations.* American Philosophical Association, Newark, DE, 1990, p. 3.
[89] Glaser, E.M. *An Experiment in the Development of Critical Thinking,* AMS Press Inc., New York, NY, 1941, pp. 5-6.

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Critical Thinking Description

Critical thinking is a quality of thinking useful when exploring a situation, question, or problem to arrive at a hypothesis or conclusion about it that integrates all available information and that can be convincingly justified.

Thinking critically requires cognitive dispositions and attitudes such as:

- Willingness to engage in intellectual effort
- Systematic
- Persistent
- Intellectual integrity
- Open-mindedness, focusing on objectivity, remaining open to what the evidence tells you

Thinking critically also depends on cognitive skills such as:

- Interpretation of information
- Analysis of information
- Evaluation of information
- Synthesis of information
- Inference from information
- Ability to explain the hypothesis or conclusion and the evidence that led to the judgment

Figure 2: Recommended Critical Thinking Description

Although this description appears to be specific and perhaps even measurable, *critical thinking* remains only a concept. We still cannot distinguish whether someone is thinking critically or not, we cannot confirm that the thinker searched sufficiently, remained in suspense long enough, and accurately evaluated, analyzed or synthesized the information in order to infer the appropriate answer.

4.2 Enablers of Critical Thinking: Skills, Dispositions, and Personal Epistemology

Now that we have established a potential characterization of critical thinking, we explore the question of those factors that enable someone to *think critically.*

Many critical thinking scholars have addressed the question of what skills are needed to think critically. Many more have emphasized the importance of individual characteristics, typically called *thinking dispositions,* because they believe that one can have a skill related to critical thinking, yet not use the skill without a disposition or motivation to think critically.

In addition to the issues surrounding skills and dispositions, another factor that contributes to a person's critical thinking ability is his or her *personal epistemology*, or beliefs about knowledge and knowing. Educational and developmental psychologists researching the topic of personal epistemology have found that an individual's beliefs about knowledge and knowing have an impact on a person's ability and propensity to think critically. A particular set of epistemological beliefs can lead one person to accept information without assessment while contrasting epistemological beliefs can lead another person to question information actively. A mature personal epistemology can be thought of as the foundation for dispositions that lead to critical

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thinking. Although a number of researchers are active in the field of personal epistemology, the majority of authors focused on critical thinking do not acknowledge the role of personal epistemology in their work.

This section of the report explores these enablers of critical thinking:

- Critical thinking skills – as defined by scholars, as defined for intelligence analysts, and recommendations
- Critical thinking dispositions – as defined by scholars, as defined for intelligence analysts, and recommendations
- Personal epistemology – an introduction to the concept of personal epistemology and how it relates to critical thinking

4.2.1. Critical Thinking Skills

Dictionary.com defines skill as "the ability, coming from one's knowledge, practice, aptitude, etc., to do something well." Merriam-Webster.com defines skill as "a learned power of doing something competently; a developed aptitude or ability." A thinking skill, therefore, is a cognitive operation that one can and should learn to do proficiently.

The description of critical thinking in Figure 2 provides a useful starting point for identifying discrete critical thinking skills:

- Interpretation
- Analysis
- Evaluation
- Synthesis
- Inference
- Ability to explain a hypothesis or conclusion, as well as the evidence that led to the judgment

One challenge in understanding and evaluating the skills proposed by different scholars is the very different approaches used to describe the skills. Some scholars focused on individual actions such as "Determine the reliability of a source." Some scholars focused on the outcome of the thinking activity such as "Present a coherent and persuasive argument on a controversial, contemporary topic." Some focused on high-level cognitive thinking skills such as inference, and some included all three types.

An additional difference in approach to describing skills is how well-rounded the lists of skills are. Some scholars wrote about just one or two of the skill areas identified in Figure 2, while others provided a more complete view of skills.

Scholarly Lists of Critical Thinking Skills: Edward Glaser provided one of the earliest lists of critical thinking skills in his 1941 report on *An Experiment in the Development of Critical Thinking*. Glaser's list is fairly well-rounded, touching on multiple aspects of critical thinking, including analysis, evaluation, inference, interpretation, and synthesis. His list of critical thinking skills included the ability to:

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- recognize problems
- find workable means for meeting those problems
- gather and marshal pertinent information
- recognize unstated assumptions and values
- comprehend and use language with accuracy, clarity, and discrimination
- interpret data
- appraise evidence and evaluate arguments
- recognize the existence (or non-existence) of logical relationships between propositions
- draw warranted conclusions and generalizations
- test the conclusions and generalizations at which one arrives
- reconstruct one's patterns of beliefs on the basis of wider experience
- render accurate judgments about specific things and qualities in everyday life [90]

Although Glaser's list is comprehensive, other authors rarely cited it.

As with other aspects of critical thinking, the literature reveals diverse perspectives on the importance of critical thinking skills and disagreement on which of these skills are actually important. Even individual scholars changed their perspective over time. For example, Robert Ennis fundamentally changed his list of skills from his initial 1962 list in "A Concept of Critical Thinking" to his 1987 article called "A Taxonomy of Critical Thinking Dispositions and Abilities." Table 3 shows how Ennis' lists of skills evolved.

[90] Glaser, E.M. *An Experiment in the Development of Critical Thinking,* AMS Press Inc., New York, NY, 1941,pp. 5-6.

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Table 3: Critical Thinking Skills as Defined by Ennis Over Time

A Concept of Critical Thinking [91]	*A Taxonomy of Critical Thinking Dispositions and Abilities* [92]
1. Grasping the meaning of a statement. 2. Judging whether there is ambiguity in a line of reasoning. 3. Judging whether certain statements contradict each other. 4. Judging whether a conclusion follows necessarily. 5. Judging whether a statement is specific enough. 6. Judging whether a statement is actually the application of a certain principle. 7. Judging whether an observation statement is reliable. 8. Judging whether an inductive conclusion is warranted. 9. Judging whether the problem has been identified. 10. Judging whether something is an assumption. 11. Judging whether a definition is adequate. 12. Judging whether a statement made by an alleged authority is acceptable.	1. Focusing on a question 2. Analyzing arguments 3. Asking and answering questions of clarification and/or challenge 4. Judging the credibility of a source 5. Observing and judging observation reports; criteria: 6. Deducing and judging deductions 7. Inducing and judging inductions (including inference) 8. Making value judgments 9. Defining terms, and judging definitions in three dimensions 10. Identifying assumptions 11. Deciding on an action 12. Interacting with others

Table 4 illustrates four different scholarly approaches:

- Barry Beyer (educator) included many individual actions, most of which fit into the skill category of evaluation.
- Alec Fisher and Michael Scriven (philosophers) strongly emphasized the word *critical* and addressed several categories of critical thinking skills (e.g. interpretation, analysis) but missed the important category of inference and expanded into areas beyond critical thinking (e.g. critical knowledge).
- Diane Halpern (psychologist) provided actions rather than skills and contained items in common with other critical thinking lists (e.g. synthesis) as well as skills that pertain to cognition in general (e.g. recall and learning).
- The Foundation for Critical Thinking (education and philosophy) also addressed some from our definition (e.g. interpretation and inference), but also went beyond to address the context in which thinking takes place (e.g. concepts, points of view).

[91] Ennis, R.H. "A Concept of Critical Thinking," *Harvard Educational Review*, Vol. 32, No. 1, 1962, p. 84.
[92] Ennis, R.H. "A Taxonomy of Critical Thinking Dispositions and Abilities," in *Teaching Thinking Skills: Theory and Practice*, eds. J.B. Baron & R.J. Sternberg, Freeman, New York, NY, 1987, pp. 12-15.

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Table 4: Comparison of Critical Thinking Skills by Different Scholars

Beyer [93]	Fisher & Scriven [94]	Halpern [95]	Foundation for Critical Thinking [96]
1. Distinguishing between verifiable facts and value claims. 2. Determining the reliability of a source. 3. Determining the factual accuracy of a statement 4. Distinguishing relevant from irrelevant information, claims or reasons. 5. Detecting bias. 6. Identifying unstated assumptions. 7. Identifying ambiguous or equivocal claims or arguments. 8. Recognizing logical inconsistencies or fallacies in a line of reasoning. 9. Distinguishing between warranted or unwarranted claims. 10. Determining the strength of an argument.	1. Critical Interpretation: Critical Reading, Listening, Observing • Level 1. Active (or deep) understanding • Level 2. Active inquiry • Level 3. Active generalization • Level 4. Active self-scrutiny 2. Critical Communication: Critical Writing, Speaking and Presenting 3. Critical Knowledge • The Standard English Vocabulary For Critical Interpretation and Appraisal • A Minimum Technical Vocabulary From Logic • Knowledge About The 'Missing In Action' Areas 4. Critical Technique • The Interpretation Of Context • The Clarification Of Meaning • The Analysis Of Arguments • The Synthesis Of Considerations	• Recognize semantic slanting and guilt by association. • Seek out contradictory evidence. • Use the metacognitive knowledge that allows novices to monitor their own performance and to decide when additional help is needed. • Make risk: benefit assessments. • Generate a reasoned method for selecting among several possible courses of actions. • Give reasons for choices as well as varying the style and amount of detail in explanations depending on who is receiving the information. • Recall relevant information when it is needed. • Use skills for learning new techniques efficiently and relating new knowledge to information that was previously learned. • Use numerical information including the ability to think probabilistically and express thoughts numerically. • Understand basic research principles. • Demonstrate an advanced ability to read and write complex prose. • Present a coherent and persuasive argument on a controversial, contemporary topic. • Provide complex instructions in language that is appropriate for the audience. • Use matrices and other diagrams for communication. • Synthesize information from a variety of sources. • Determine credibility and use this information in formulating and communicating decisions.	The competencies focusing on the elements of reasoning and the universal intellectual standards as they relate to the elements: 1. Purposes, goals, and objectives 2. Questions, problems, and issues 3. Information, data, evidence, and experience 4. Inferences and interpretations 5. Assumptions & presuppositions 6. Concepts, theories, principles, definitions, laws, & axioms 7. Implications and consequences 8. Points of view and frames of reference The competency focusing on the universal intellectual standards: 9. Assessing thinking

[93] Beyer, B.K. "Critical Thinking: What is it?" *Social Education,* Vol. 49, No. 4, 1985, p. 272.
[94] Fisher, A. & Scriven, M. *Critical Thinking: Its Definition and Assessment,* Edgepress, Point Reyes, CA, 1997, pp. 94-113.
[95] Halpern, D.F. *Thought and Knowledge: An Introduction to Critical Thinking,* Lawrence Erlbaum Associates, Mahwah, NJ, 2003, pp. 14-15.
[96] Paul, R. & Elder, L. *A Guide for Educators to Critical Thinking Competency Standards,* Foundation for Critical Thinking, Dillon Beach, CA, 2006, p. 14.

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Table 5 summarizes widely used critical thinking assessments and the skills each evaluates. Reviewing the assessments provides insight into what thinking skills the authors of the assessments considered important and how the authors categorized the skills.

Table 5: Critical Thinking Skills as Assessed in Primary Critical Thinking Assessments

Watson-Glaser Critical Thinking Appraisal II [97]	**Cornell Critical Thinking Test** [98]	**The Ennis-Weir Critical Thinking Essay Test** [99]	**CCTST** [100]
• Recognize Assumptions • Evaluate Arguments • Draw conclusions	Level X: • Induction • Deduction • Observation • Credibility • Assumption Identification Level Z: • Induction • Deduction • Observation • Credibility • Assumption Identification • Meaning	• Getting the point • Seeing the reasons and assumptions • Stating one's point • Offering good reasons • Seeing other possibilities • Responding appropriately to and/or avoiding: + Equivocation + Irrelevance + Circularity + Reversal of an "if-then" (or other + conditional) relationship + The straw person fallacy + Overgeneralization + Excessive skepticism + Credibility problems + The use of emotive language to persuade	• Analysis • Interpretation • Inference • Evaluation • Inductive reasoning • Deductive reasoning

The participants in the 1990 APA study led by Peter Facione identified major categories of skills with related sub-skills. This representation of critical thinking skills overlaps the skills in our description of critical thinking as presented in Figure 2. Several documents quoted these skills, including a US Department of Education's study[101] about critical thinking. Facione also provided this caveat summarizing the perspective of the APA study participants about skills:

[97] Watson, G. & Glaser, E.M. *Watson-Glaser II Critical Thinking Appraisal Technical Manual and User's Guide*, NCS Pearson, Inc., San Antonio, TX, 2009, p.2.
[98] Ennis, R.H., Millman, J. & Tomko, T.N. *Cornell Critical Thinking Tests Level X & Level Z Manual*, 5th ed., The Critical Thinking Co., Seaside, CA, 2005, p. 2.
[99] Ennis, R.H. & Weir, E. *The Ennis-Weir Critical Thinking Essay Test*, Midwest Publications, Pacific Grove CA, 1985, p. 1.
[100] "California Critical Thinking Skills Tests," Insight Assessment. Available: http://www.insightassessment.com/, Viewed: April 29, 2010.
[101] Jones, E.A., Hoffman, S., Moore, L.M., Ratcliff, G., Tibbetts, S. & Click, B.A.L. *National Assessment of College Student Learning: Identifying College Graduates' Essential Skills in Writing, Speech and Listening, and Critical Thinking. Final Project Report*, National Center on Post Secondary Teaching, Learning, and Assessment, University Park, PA, 1995.

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The experts caution that CT skills can usefully be grouped and subclassified in a number of legitimate ways. Hence, the sub-classification which resulted from this Delphi research should not be interpreted as necessarily excluding all others. Indeed, while declaring themselves to be in agreement with this sub-classification, various participating experts have also published their own sub-classifications.[102]

The APA study identified the following critical thinking skills and sub-skills:

1. Interpretation - To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria.
    - Categorization
    - Decoding Significance
    - Clarifying Meaning
2. Analysis - To identify the intended and actual inferential relationships among statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgments, experiences, reasons, information, or opinions.
    - Examining Ideas
    - Identifying Arguments
    - Analyzing Arguments
3. Evaluation - To assess the credibility of statements or other representations which are accounts or descriptions of a person's perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intend inferential relationships among statements, descriptions, questions or other forms of representation.
    - Assessing Claims
    - Assessing Arguments
4. Inference - To identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.
    - Querying Evidence
    - Conjecturing Alternatives
    - Drawing Conclusions
5. Explanation - To state the results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments.
    - Stating Results
    - Justifying Procedures
    - Presenting Arguments

[102] Facione, p. 11.

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6. Self-Regulation - Self-consciously to monitor one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis and evaluation to one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results.
    - Self examination
    - Self-correction [103]

Critical Thinking Skills Defined in the Intelligence Analysis Literature: A total of seven documents identified specific skills associated with critical thinking that apply to intelligence analysis. Although overlaps in these lists exist, a common understanding of the skills required to think critically does not appear to exist within the intelligence community.

Two documents[104] referenced the skills from the APA study and described how these skills relate to intelligence analysis.

David Moore's *Critical Thinking and Intelligence Analysis* provided a synthesis and interpretation of skills as defined by Glaser, Halpern, Fisher, and the Foundation for Critical Thinking:

Competencies of Critical Thinkers

- Recognize problems or questions and find effective means of solution
- Engage in meta-cognitive activities that identify assumptions, biases, and performance as solutions are developed
- Interpret data, appraise evidence, and evaluate statements in order to recognize logical relationships between propositions
- Infer warranted conclusions and generalizations from evidence
- Test generalizations and conclusions by seeking out contradictory evidence that enables them to judge the credibility of claims
- Convey sound, well-reasoned arguments
- Focus on the process of reasoning with the intention of improving the process[105]

ICD Number 610 contains the competency directories for the IC workforce. Two of the intelligence analysis documents[106] that listed critical thinking skills used this list. The skills and sub-skills identified for critical thinking for non-supervisory IC employees at GS-15 and below include:

- Logic
- Analysis

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[103] Facione, pp. 13-19.
[104] Tam, C.K. *Behavioral and Psychosocial Considerations in Intelligence Analysis: A Preliminary Review of Literature on Critical Thinking Skills*, AFRL-RH-AZ-TR-1009-0009, Air Force Research Laboratory, Mesa, AZ, 2009 and Hess, J. & Friedel, C. "Applying Critical Thinking to Intelligence Analysis," *American Intelligence Journal*, Vol. 26, No. 1, 2008, pp. 31-44.
[105] Moore, D.T. *Critical Thinking and Intelligence Analysis*, Joint Military Intelligence College, Washington, D.C., 2006, p. 14.
[106] Anonymous. *National Defense Intelligence College. Academic Year 2008-2009*, National Defense Intelligence College, Washington, D.C., [undated] and Spracher, W.C. *National Security Intelligence Professional Education: A Map of U. S. Civilian University Programs and Competencies*, Ph.D. dissertation, George Washington University, 2009.

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- Synthesis
- Evaluation
- Creativity, creative thinking
- Judgment
- Exploring alternatives
- Enterprise perspective
- Situational awareness[107]

The skills and sub-skills identified for supervisory and managerial IC employees at GS-15 and below include:

- Logic
- Analysis
- Synthesis
- Evaluation
- Creativity
- Judgment
- Decisiveness
- Flexibility
- Problem solving[108]

Critical Thinking Skills in This Report: I reviewed the skills listed in all documents related to critical thinking and compared them with our description of critical thinking in Figure 2. As a result of this comparison, it became clear that the broad categories of skills provided in our description, combined with the addition of self-regulation from the APA study, provide a useful summary of the major skills that enable intelligence analysts to think critically. Therefore, my recommended list of critical thinking skills is:

- Interpretation
- Analysis
- Evaluation
- Inference
- Synthesis
- Explanation
- Self-regulation

Table 6 illustrates how a selection of the skills identified by various authors map to these skills.

[107] Office of the Director of National Intelligence. *Intelligence Community Directive Number 610. Competency Directories for the Intelligence Community Workforce.* 2008, p. B-2.
[108] Office of the Director of National Intelligence, pp. C-1 – C-2.

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Table 6: Recommended Critical Thinking Skills for Intelligence Analysis Mapped to Skills Identified by Scholars

Interpretation	Analysis	Evaluation	Inference
+ Categorization + Decoding Significance + Clarifying Meaning + Interpret data + Comprehend language with accuracy, clarity, and discrimination + Grasping the meaning of a statement + Judging whether a statement is over vague or over specific + Interpreting information + Asking and answering questions of clarification and/or challenge + Observing and judging observation reports; criteria + Critical interpretation: critical reading, listening, observing + The interpretation of context	+ Examining Ideas + Identifying Arguments + Analyzing Arguments + Recognize the existence (or non-existence) of logical relationships between propositions, + Recognizing organizing techniques or principles + Analysis of related parts of a problem + Analysis of arguments + Recognizing logical inconsistencies or fallacies	+ Assessing Claims + Assessing Arguments + Appraise evidence and evaluate arguments + Identifying unstated assumptions and values + Distinguishing between verifiable facts and value claims. + Evaluating sources of information + Distinguishing relevant from irrelevant information, claims or reasons. + Detecting bias + Distinguishing between warranted or unwarranted claims. + Recognizing the adequacy of data + Recognizing persuading techniques	+ Querying Evidence + Conjecturing Alternatives + Drawing Conclusions + Draw warranted conclusions and generalizations + Render accurate judgments about specific things and qualities in everyday life + Deducing and judging deductions + Inducing and judging inductions + Judging whether a conclusion follows, is warranted + Distinguish hypothesis from evidence + Distinguish hypothesis from warranted conclusion + Construct arguments supporting judgment
Explanation	**Self-Regulation**	**Synthesis**	
+ Stating Results + Justifying Procedures + Presenting Arguments + Use language with accuracy, clarity, and discrimination + Interacting with others + Critical Communication: Critical Writing, Speaking and Presenting + Demonstrate an advanced ability to read and write complex prose. + Present a coherent and persuasive argument on a controversial, contemporary topic. + Use matrices and other diagrams for communication.	+ Self examination + Self-correction + Test the conclusions and generalizations at which one arrives + Refraining from jumping to conclusion + Retention of an open mind. + Be aware of own point of view and biases this may cause + Revise argument in light of new evidence + Seek out contradictory evidence. + Use the metacognitive knowledge that allows novices to monitor their own performance and to decide when additional help is needed.	+ The synthesis of considerations + Synthesize information from a variety of sources. + Synthesis	

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4.2.2. Critical Thinking Dispositions

The ability to employ critical thinking skills is still not sufficient to ensure that an individual will bring a critical approach to thinking. A thinker must be willing to make the extra effort to think critically. The thinker must have the *disposition* to think critically.

The concern with thinking dispositions was even more popular in the literature than critical thinking skills. Fifty four documents addressed the topic of skills while 71 addressed thinking dispositions. Just as with critical thinking skills, the specific dispositions associated with critical thinking have varied over the years and between authors.

Merriam-Webster.com defines disposition as, "prevailing tendency, mood, or inclination." Dictionary.com defines disposition as, "state of mind regarding something; inclination." It is interesting to note that the majority of scholars who wrote about dispositions described them as something that could be taught and developed, similar to teaching and developing skills. For example, Barry Beyer noted:

> Dispositions such as those noted here do not necessarily develop on their own. They, too, must be taught. These dispositions are ***not,*** however, taught in exactly the same ways as are the skilled operations of thinking. Teaching them takes much longer than does teaching a specific skill and requires use of direct as well as indirect teaching techniques and strategies.[109]

Our description of critical thinking in Figure 2 included five dispositional characteristics:

- Willingness to engage in intellectual effort
- Systematic
- Persistent
- Intellectual integrity
- Open-mindedness, a focus on objectivity, remaining open to what the evidence tells you

The earliest critical thinking scholars highlighted the importance of a critical attitude. In *How We Think,* John Dewey noted that a thinker needs more than skills. He identified three primary dispositions: open mindedness, whole heartedness, and responsibility:

> Knowledge of the methods alone will not suffice; there must be the desire, the will, to employ them. This desire is an affair of personal disposition. But on the other hand the disposition alone will not suffice. There must also be understanding of the forms and techniques that are the channels through which these attitudes operate to the best advantage.[110]

Glaser also identified the importance of the thinker's attitude. His definition of critical thinking starts with an emphasis on the importance of attitude:

[109] Beyer, B.K. *Practical Strategies for the Teaching of Thinking,* Allyn and Bacon, Boston, MA, 1987, p. 211.
[110] Dewey, J. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process,* 2nd ed., Regnery, Chicago, IL, 1933, p. 30 .

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> The ability to think critically, as conceived in this volume, involves three things: (1) an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experiences,[111]

He followed his definition with this explanation:

> The development of ability to think critically, it should be noted, is not limited to cultivation of better methods for finding and testing evidence and meanings, and arriving at well-founded conclusions. Knowledge of the methods of logical inquiry is important. Even more important for the everyday practice of democracy, however, are the *attitudes* involved in critical thinking. Persons who have acquired a disposition to *want* evidence for beliefs, and who have acquired an attitude of reasonableness have also acquired something of a way of life which makes for more considerate and humane relationships among men.[112]

Not all authors stated a belief in the importance of dispositions. Michael Fisher and Alec Scriven provided a contrary view:

> A deeper issue comes up here, too, about the affective (values) dimension. We'll go into it a little, because it is a key issue about the nature of critical thinking, and because Facione was awarded a big federal contract for further work on critical thinking (1995), so his view is likely to become more influential. Facione supports the inclusion of (ten) affective variables, while reporting that one third of his Delphi group - this was the largest dissident group on any topic - supported the view expressed in this chapter, that critical thinking should be defined simply as a skilled cognitive process. Unfortunately, the dissident minority did not provide a set of items that refer to what he describes as their view. They may have been rejecting what we have called the 'active' requirement, not the inclusion of affective variables.[113]

Scholarly Lists of Critical Thinking Dispositions: As with skills, a single author may use different language at different times to describe dispositions. For example, Peter Facione, the author of the APA report on critical thinking, described the ideal critical thinker and also provided a list of critical thinking dispositions in the same report. Overlap exists between the two lists, but they are not consistent. When Facione wrote about the CCTDI in later publications, he described broad categories of dispositions rather than the list of dispositions in the APA study. Facione's refinement of dispositions is shown in Table 7.

[111] Glaser, E.M. *An Experiment in the Development of Critical Thinking*, AMS Press Inc., New York, NY, 1941, p. 5.
[112] Glaser, p. 6.
[113] Fisher, A. & Scriven, M. *Critical Thinking: Its Definition and Assessment*, Edgepress, Point Reyes, CA, 1997, p. 81.

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Table 7: Critical Thinking Dispositions as Defined by Facione Over Time

APA/Facione[114]	**APA/Facione**[115]	**Facione**[116]
The ideal critical thinker is • habitually inquisitive • well informed • trustful of reason • open-minded • flexible • fair-minded in evaluation • honest in facing personal biases • prudent in making judgments • willing to reconsider • clear about issues • orderly in complex matters • diligent in seeking relevant information • reasonable in the selection of criteria • focused in inquiry • persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit.	Affective Dispositions of Critical Thinking Approaches to life and living in general • clarity in stating the question or concern, • inquisitiveness with regard to a wide range of issues, • concern to become and remain generally well-informed, • alertness to opportunities to use CT, • trust in the processes of reasoned inquiry, • self-confidence in one's own ability to reason, • open-mindedness regarding divergent world views, • flexibility in considering alternatives and opinions, • understanding of the opinions of other people, • fair-mindedness in appraising reasoning, • honesty in facing one's own biases, prejudices, stereotypes, egocentric or sociocentric tendencies, • prudence in suspending, making or altering judgments, • willingness to reconsider and revise views where honest reflection suggests that change is warranted. Approaches to specific issues, questions, or problems: • clarity in stating the question or concern, • orderliness in working with complexity, • diligence in seeking relevant information, • reasonableness in selecting and applying criteria, • care in focusing attention on the concern at hand, • persistence though difficulties are encountered, • precision to the degree permitted by subject and circumstances.	CCTDI assess for: • truthseeking, • openmindedness, • analyticity, • systematicity, • critical thinking self-confidence, • inquisitiveness, • maturity of judgment

[114] Facione, P.A. *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research Findings and Recommendations.* American Philosophical Association, Newark, DE, 1990, p. 3.
[115] Facione, p. 25.
[116] Facione, P.A., Facione, N.C. & Giancarlo, C.A. "The Disposition Toward Critical Thinking: Its Character, Measurement, and Relationship to Critical Thinking Skill," *Informal Logic*, Vol. 20, No. 1, 2000, p.74.

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Table 8 provides a comparison of dispositions from the scholars who provided the lists of skills in Table 4.

- Robert Ennis (philosopher and educator)
- Barry Beyer (educator)
- Diane Halpern (psychologist)
- Foundation for Critical Thinking (education and philosophy)

Alec Fisher and Michael Scriven (philosophers) do not believe dispositions are as important as skills and did not identify any. Therefore, they are not included in the table.

To replace Fisher and Scriven, I included dispositions defined by Keith Stanovich, a psychologist, in Table 8. Stanovich has written extensively on the impact that thinking dispositions have on reasoning ability.[117]

[117] For example see Stanovich, K.E. *Who is Rational? Studies of Individual Differences in Reasoning,* L. Erlbaum Associates, Mahwah, NJ, 1999, Stanovich, K.E. & West, R.F. "Individual Differences in Rational Thought," *Journal of Experimental Psychology: General,* Vol. 127, No. 2, 1998, pp. 161-188, Stanovich, K.E. *What Intelligence Tests Miss: The Psychology of Rational Thought,* Yale University Press, New Haven, CT, 2009.

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Table 8: Comparison of Critical Thinking Dispositions by Different Scholars

Ennis [118]	Beyer[119]	Halpern[120]	Foundation[121]	Stanovich[122]
1. Seek a clear statement of the thesis or question 2. Seek reasons 3. Try to be well informed 4. Use and mention credible sources 5. Take into account the total situation 6. Try to remain relevant to the main point 7. Keep in mind the original and/or basic concern 8. Look for alternatives 9. Be open-minded a) Consider seriously other points of view than one's own (dialogical thinking) b) Reason from premises with which one disagrees—without letting the disagreement interfere with one's reasoning (suppositional thinking) c) Withhold judgment when the evidence and reasons are insufficient 10. Take a position (and change a position) when the evidence and reasons are sufficient to do so 11. Seek as much precision as the subject permits 12. Deal in an orderly manner with the parts of a complex whole 13. Use one's critical thinking abilities 14. Be sensitive to the feelings, level of knowledge, and degree of sophistication of others	1. Seek a clear statement of a problem, a thesis, a question. 2. Deliberately examine a variety of viewpoints. 3. Seek to be well informed. 4. Use credible sources. 5. Seek a number of alternatives. 6. Seek/give reasons. 7. Seek/provide evidence. 8. Be open-minded. 9. Be willing to change a position/judgment when evidence and reasons are sufficient to do so. 10. Judge in terms of situations, issues, purposes, and consequences (not in terms of fixed, dogmatic precepts or emotional, wistful thinking). 11. Persist in carrying out a thinking task. 12. Be slow to believe—be skeptical. 13. Be objective. 14. Suspend judgment when appropriate/sufficient evidence and reasoning are lacking.	1. Willingness to Plan 2. Flexibility 3. Persistence 4. Willingness to Self-Correct, Admit Errors, and Change Your Mind When the Evidence Changes 5. Being Mindful 6. Consensus Seeking	• Fairmindedness • Intellectual Humility • Intellectual Courage • Intellectual Empathy • Intellectual Integrity • Intellectual Perseverance • Confidence in Reason • Intellectual Autonomy	• the tendency to collect information before making up one's mind, • the tendency to seek various points of view before coming to a conclusion, • the disposition to think extensively about a problem before responding, • the tendency to calibrate the degree of strength of one's opinion to the degree of evidence available, • the tendency to think about future consequences before taking action, • the tendency to explicitly weigh pluses and minuses of situations before making a decision, • and the tendency to seek nuance and avoid absolutism

[118] Ennis, R.H. "A Taxonomy of Critical Thinking Dispositions and Abilities," in *Teaching Thinking Skills: Theory and Practice*, eds. J.B. Baron & R.J. Sternberg, Freeman, New York, NY, 1987, p. 12.
[119] Beyer, B.K. *Practical Strategies for the Teaching of Thinking*, Allyn and Bacon, Boston, MA, 1987, p. 212.
[120] Halpern, D.F. *Thought and Knowledge: An Introduction to Critical Thinking*, Lawrence Erlbaum Associates, Mahwah, NJ, 2003, pp. 15-17.
[121] Paul, R. & Elder, L. *A Guide for Educators to Critical Thinking Competency Standards*, Foundation for Critical Thinking, Dillon Beach, CA, 2006, pp. 14-15.
[122] Stanovich, K.E. *What Intelligence Tests Miss: The Psychology of Rational Thought*, Yale University Press, New Haven, CT, 2009, pp. 31-32.

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Critical Thinking Dispositions in the Intelligence Analysis Literature: Only one document in the intelligence analysis literature discussed critical thinking dispositions. The lack of attention regarding thinking dispositions in the intelligence literature may represent an omission within the intelligence community's body of knowledge.

David Moore in *Critical Thinking and Intelligence Analysis* referenced the Facione umbrella dispositions from the CCTDI (listed in Table 7) and a list of dispositions defined by Richard Paul and Gerald Nosich, both associated with the Foundation for Critical Thinking.

> According to Richard Paul and Gerald Nosich, the characteristics of critical thinkers include thinking independently, exercising fair-mindedness, developing insight into egocentricity and sociocentricity, developing intellectual humility and suspending judgment, developing intellectual courage, developing intellectual good faith and integrity, developing intellectual perseverance, developing confidence in reason, exploring thoughts underlying feelings and feelings underlying thoughts, developing intellectual curiosity.[123]

Moore highlighted the connection between the dispositions as defined by Facione, Paul, and Nosich and the characteristics of successful intelligence analysts as defined by Krizan and Moore.

> Both sets closely match the characteristics of successful intelligence analysts identified by Lisa Krizan and the author in their work on intelligence analysts' core competencies. Krizan and the author observe that successful intelligence analysts are insatiably curious. Fascinated by puzzles, their high levels of self-motivation lead them to observe and read voraciously, and to take fair-minded and varied perspectives. This helps them to make the creative connections necessary for solving the hardest intelligence problems. Finally, the emotional tensions created by problems, and the cathartic release at their solution, powerfully motivate analysts.[124]

Several documents that address analyst competencies emphasize characteristics that are similar to those found in lists of thinking dispositions. For example, Lahneman's report on the future of intelligence analysis included the following traits of successful analysts. Those relevant to critical thinking are highlighted in blue:

- **Traits**
  - Natural curiosity
  - Well-rounded
  - Clear thinker
  - Critical thinker
  - Intuitive thinker
  - Team player
  - "Sees beyond the obvious"
  - Grasp of the theoretical

[123] Moore, D.T. *Critical Thinking and Intelligence Analysis*, Joint Military Intelligence College, Washington, D.C., 2006, pp. 15-16.
[124] Moore, D.T. & Krizan, L. "Intelligence Analysis: Does NSA Have What it Takes?" *Cryptologic Quarterly*, Vol. 20, No. 1-2, 2001, p. 16.

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- Self-discipline
- Ability to handle substantive uncertainty
- Ability to address alternative scenarios
- Ethics/integrity
- Flexibility/adaptability
- Fast learner
- Imagination
- Appreciate own biases/perspective[125]

Critical Thinking Dispositions in This Report: I reviewed the dispositions listed in all documents related to critical thinking and compared them with our description of critical thinking in Figure 2. As a result of this comparison, it became clear that the broad categories of dispositions provided in our description, combined with the addition of intellectual curiosity provide a useful summary of the major dispositions that enable and trigger someone to think critically.

While we have long had an understanding of common cognitive skills such as analysis, synthesis, and evaluation, the same is not true for dispositions. There is great overlap in the concepts expressed within these examples of thinking dispositions, but the language used to describe the disposition varied. For example: Ennis identified the disposition to *seek reasons*; Moore identified the disposition to be *intellectually curious*; Stanovich identified the *tendency to collect information*; and Facione identified the disposition of *inquisitiveness*. All appear to describe the same inclination toward gathering information before coming to a decision or conclusion. As a result, it is very difficult to say definitively that one term is more appropriate than another. The terms I chose to describe these dispositions represent terms that I believe to be most easily understandable.

Therefore, my recommended list of critical thinking dispositions is:

- Willingness to engage in intellectual effort
- Systematic
- Persistent
- Intellectual integrity
- Open-minded
- Intellectual curiosity

Table 9 illustrates how thinking dispositions identified by different authors fit into these categories.

[125] Lahneman, W.J. *The Future of Intelligence Analysis. Volume 1. Final Report.* Center for International and Security Studies at Maryland, College Park, MD, 2006, p. A-1.

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Table 9: Recommended Critical Thinking Dispositions Mapped to Dispositions Identified by Scholars

Willingness to Engage Intellectually	Systematic	Persistent
• Alertness to opportunities to use CT • Trust in the processes of reasoned inquiry • Use one's critical thinking abilities • Intellectual courage • Being mindful • Confidence in reason • Use one's critical thinking abilities • Self-confidence in one's own ability to reason • Ability to handle substantive uncertainty • Sees beyond the obvious • The disposition to think extensively about a problem before responding • The tendency to seek nuance and avoid absolutism	• Willingness to Plan • Take into account the total situation • Seek a clear statement of the thesis or question • Try to remain relevant to the main point • Deal in an orderly manner with the parts of a complex whole • Seek as much precision as the subject permits • Clarity in stating the question or concern, orderliness in working with complexity • Care in focusing attention on the concern at hand, • Diligence in seeking relevant information	• Intellectual Perseverance • Self discipline • Persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. • Persistence though difficulties are encountered, • Persist in carrying out a thinking task.
Open-Minded	**Intellectual Integrity**	**Intellectual Curiosity**
• Objectivity • Actively open-minded thinking • Consider seriously other points of view than one's own • Reason from premises with which one disagrees—without letting the disagreement interfere with one's reasoning • Deliberately examine a variety of viewpoints. • Fairmindedness • Open-mindedness regarding divergent world views • Flexibility in considering alternatives and opinions • Understanding of the opinions of other people • Fair-mindedness in appraising reasoning • Appreciate own biases/perspective • Ability to address alternative scenarios	• Willingness to self-correct, admit errors, and change your mind when the evidence changes • Be willing to change a position/judgment when evidence and reasons are sufficient to do so. • Withhold judgment when the evidence and reasons are insufficient • Intellectual Autonomy • The tendency to calibrate the degree of strength of one's opinion to the degree of evidence available • Prudence in suspending, making or altering judgments, • Ethics/integrity • Truthseeking • Honesty in facing one's own biases, prejudices, stereotypes, egocentric or sociocentric tendencies • Reason from premises with which one disagrees—without letting the disagreement interfere with one's reasoning (suppositional thinking)	• Try to be well informed • Inquisitiveness with regard to a wide range of issues, • Concern to become and remain generally well-informed • Natural curiosity • Deliberately examine a variety of viewpoints. • Seek to be well informed. • Use credible sources. • Seek a number of alternatives. • Seek/give reasons. • Seek/provide evidence.

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4.2.3. Personal Epistemology

The third enabler of critical thinking is personal epistemology. Researchers in personal epistemology propose that one's personal beliefs about knowledge and knowing have a fundamental impact on the disposition and ability to think critically. Although researchers describe personal epistemology in different ways (e.g. epistemic orientation, epistemological beliefs, reflective judgment) and evaluate individual perspectives in different ways (e.g. levels of understanding, categories of beliefs, developmental stages), a common theme is that an individual is more likely to engage in critical thinking when his or her personal epistemology supports a complex understanding of knowledge.

A mature personal epistemology can be thought of as the foundation for dispositions that lead to critical thinking.

The concept of personal epistemology is much broader than can be explained in this report. A separate report expanding on personal epistemology will be available in the future. However, a brief introduction to the concept of personal epistemology illustrates its potential impact on an analyst's willingness to think critically.

Barbara Hofer linked personal epistemology to critical thinking:

> Monitoring our own understanding of the complexity of problems, the certainty and limits of knowledge, and the evaluation of evidence enables the critical thinking necessary to solve the most pressing problems we may face as individuals and as a society. The importance of epistemic assumptions in the solving of ill-structured problems is another critical tie to the work of cognitive psychologists (Voss and Post, 1988), whose investigations into this area suggest the importance of such tasks in human cognition. Yet the evidence gathered to date suggests that most individuals do not achieve a level of epistemological understanding that makes possible genuine critical thinking (Kuhn, 1999a) or a level of reflective judgment essential to the solving of ill-structured problems (King and Kitchener, 1994).[126]

Deanna Kuhn et al. provided a model of epistemology that links epistemological understanding to critical thinking as shown in Figure 3. She introduced the model by saying:

> Beliefs about knowing and knowledge are potentially important determinants of intellectual performance. It is not surprising that what people believe about the acquisition of knowledge - how it occurs and what it accomplishes - influences its operation in their own lives. Empirical investigation of epistemological beliefs, however, has not been widespread and has received relatively little attention in the mainstream of developmental psychology, despite increasing interest on the part of developmental psychologists in the educational implications of their research.[127]

[126] Hofer, B.K. "Personal Epistemology Research: Implications for Learning and Teaching," *Educational Psychology Review*, Vol. 13, No. 4, 2001, p. 365.
[127] Kuhn, D., Cheney, R. & Weinstock, M. "The Development of Epistemological Understanding," *Cognitive Development*, Vol. 15, No. 3, 2000, pp. 309-310.

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Levels of epistemological understanding

Level	Assertions	Reality	Knowledge	Critical thinking
Realist	Assertions are COPIES of an external reality.	Reality is directly knowable.	Knowledge comes from an external source and is certain.	Critical thinking is unnecessary.
Absolutist	Assertions are FACTS that are correct or incorrect in their representation of reality (possibility of false belief).	Reality is directly knowable.	Knowledge comes from an external source and is certain.	Critical thinking is a vehicle for comparing assertions to reality and determining their truth or falsehood.
Multiplist	Assertions are OPINIONS freely chosen by and accountable only to their owners.	Reality is not directly knowable.	Knowledge is generated by human minds and is uncertain.	Critical thinking is irrelevant.
Evaluativist	Assertions are JUDGMENTS that can be evaluated and compared according to criteria of argument and evidence.	Reality is not directly knowable.	Knowledge is generated by human minds and is uncertain.	Critical thinking is valued as a vehicle that promotes sound assertions and enhances understanding.

Figure 3: Kuhn's Levels of Epistemological Understanding[128]

Kuhn explained the levels of epistemological understanding shown in Figure 3:

> We propose that the developmental task that underlies the achievement of mature epistemological understanding is the coordination of the subjective and objective dimensions of knowing. Initially, the objective dimension dominates, to the exclusion of subjectivity. Subsequently, in a radical shift, the subjective dimension assumes an ascendant position and the objective is abandoned. Finally, the two are coordinated, with a balance achieved in which neither overpowers the other.
>
> This progression is reflected in the sequence of levels depicted in Table 1. Someone at the absolutist (as well as the preabsolutist realist) level sees knowledge as an objective entity, as located in the external world and knowable with certainty. In what we take to be a key event in the development of epistemological thought, the multiplist relocates the source of knowledge from the known object to the knowing subject, hence becoming aware of the uncertain, subjective nature of knowing. This awareness comes to assume such proportions, however, that it overpowers and obliterates any objective standard that could serve as a basis for comparison or evaluation of conflicting claims. Because claims are subjective opinions freely chosen by their holders and everyone has a right to their opinion, all opinions are equally right.
>
> The evaluativist reintegrates the objective dimension of knowing, by acknowledging uncertainty without forsaking evaluation. Thus, two people can both have legitimate positions – can both "be right" – but one position can have more merit ("be more right") than the other to the extent that position is better supported by argument and evidence.[129]

Personal epistemology has not yet received any attention in the intelligence literature. Because an individual's personal epistemology affects how he or she views knowledge, it has an impact on how an analyst processes information and how willing and able he or she is to think critically. It is a concept worthy of more attention in the intelligence literature.

[128] Kuhn, p. 311.
[129] Kuhn, pp. 310-312.

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4.2.4. Summary: Enablers of Critical Thinking

I developed Table 10 as a model of critical thinking skills, dispositions, and personal epistemology that may be useful in understanding what is required to think critically.

Table 10: Recommended Critical Thinking Skills, Dispositions, and Personal Epistemology

Critical Thinking Skills	Critical Thinking Dispositions
Interpretation Analysis Evaluation Inference Synthesis Explanation Self-regulation	Willingness to engage in intellectual effort Systematic Persistent Intellectual integrity Open-minded Intellectual curiosity
Personal Epistemology Mature level that enables critical thinking	

4.3 Can We Train Someone to Think Critically?

We now understand what critical thinking is and what skills, dispositions, and personal epistemology enable someone to think critically. We turn our attention to the next question: Can we train someone to be a critical thinker? As noted earlier in the report, teaching critical thinking has long been of interest as demonstrated by the United States Educational Policies Commission 1938 report, the article published in 1939 in the *New York Times* about Cornell University's experiment in teaching critical thinking, and Edward Glaser's 1941 experiment in teaching critical thinking.

Despite much attention, little agreement exists about how to teach critical thinking effectively. Ongoing questions include what topics to address when teaching critical thinking; what teaching approaches such as lecture, discussion, and practice are most effective; how much time it takes for someone to learn to think critically habitually and effectively; and whether critical thinking can be taught as an independent concept or can only be taught in conjunction with a specific topic such as history.

In this section we explore:

- Studies about and approaches for infusing critical thinking into the K-12 and college educational systems
- Lessons learned from specific experiments and longitudinal studies
- Examples of critical thinking training courses
- Summary of what is required to train someone to think critically

4.3.1. Infusing Critical Thinking into the Educational System

Deanna Kuhn highlighted the fundamental difficulty of teaching thinking to K-12 students in *Education for Thinking*: what content should be included when teaching critical thinking? This question is directly related to the widespread inability to agree on what critical thinking is and what skills are required to think critically.

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What Are Inquiry Skills?

> Compare a teacher's position in seeking to develop students' inquiry skills versus their literacy or mathematical skills. In the latter case, the teacher can draw on a plethora of finely calibrated assessment instruments that have been widely accepted as identifying a student's level of achievement with great accuracy - a student's reading level is routinely identified, for example, as year six, month five. Classroom teachers are not only able but in fact usually required to undertake frequent assessments of these skill levels, and evaluations of the teacher's own performance are influenced by the results. There is little ambiguity here about what students have or have not achieved. Nor is there any scarcity of curriculum materials designed to promote this achievement.
>
> Inquiry skills, in contrast, lack even a clear subject area. Most often, inquiry skills are regarded as part of science education, and virtually all current curriculum standards in science education include inquiry skills. But inquiry skills are also commonly found as curriculum goals in Social Studies and even in language arts (e.g., Levstik and Barton, 2001, p. xi). Y et even in science, where they are most prevalent, these goals and standards remain couched in the most general of terms.[130]

Kuhn continued:

> Even the most conscientious and informed teachers are left with little to go on. A vast, seemingly uncharted terrain remains between executing the activity and developing the skills. How does a teacher help a student to "analyze and interpret data" or to "think critically and logically to make the relationships between evidence and explanations"? What teachers have to settle for is assessment of the activities themselves rather than the skills that students do or do not display in engaging them. If an activity seems a "rich" one - that is, one that students maintain sustained involvement in over a period of time without losing interest - then it is deemed an inquiry activity successful for the age group. But even in these relatively favorable circumstances, teachers would be hard-pressed to identify just what skills the students are acquiring or to document their progress.[131]

Daniel Willingham noted another challenge to helping K-12 students learn to think critically – that of transfer. Can someone take the knowledge learned in the classroom and apply it in multiple situations?

> Since the ability to think critically is a primary goal of education, it's no surprise that people have tried to develop programs that could directly teach students to think critically without immersing them in any particular academic content. But the evidence shows that such programs primarily improve students' thinking with the sort of problems they practiced in the program - not with other types of problems. More generally, it's doubtful that a program that effectively teaches students to think critically in a variety of situations will ever be developed.[132]

At the college level, Elizabeth Jones et al. noted deficiencies in critical thinking education:

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[130] Kuhn, D. *Education for Thinking,* Harvard University Press, Cambridge, MA, 2005, p. 40.
[131] Kuhn, p. 41.
[132] Willingham, D.T. "Critical Thinking: Why is it so Hard to Teach?,"*American Educator,*Vol. 31, No. 2, 2007, p. 12.

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> Faculty often state that they are seeking to develop students' abilities to analyze, synthesize, and think critically. However, research indicates that faculty do not follow their good intentions when they develop their courses. A formal review and analysis of course syllabi and exams revealed that college faculty do not in reality focus on these advanced skills and instead are far more concerned with students' abilities to acquire knowledge, comprehend basic concepts or ideas and terms, and apply this basic knowledge (Ratcliff, 1994; Ratcliff, Jones, Guthrie, & Oehler, 1991). While gathering data on actual behaviors is more difficult, it is necessary since perceptions do not match actions.[133]

Diane Kelly-Riley et al., in a study at Washington State University, confirmed the problems with inconsistent teaching that contributed to a lack of learning critical thinking:

> As we expanded our pool of faculty participants in the Higher Education Coordinating Board (HECB) study, we found that some instructors demonstrated a substantial need for support in revising their practices of instruction and evaluation. That is, their habitual teaching approaches did not elicit critical thinking from their students, and it was not easy for them to change to a mode that would.[134]

Despite these challenges, there has been tremendous interest in the topic of teaching thinking. A sample of the books and articles found during the research for this report includes:

- *Thinking and Learning to Think*[135] (1901)
- *How We Think*[136] (1910 and1933)
- "Teaching to Think"[137] (1933)
- "An Experiment in Teaching Certain Skills of Critical Thinking"[138] (1944)
- *Critical Thinking and Education*[139] (1981)
- "Needed: Better Methods for Teaching Higher-Order Thinking Skills"[140] (1985)
- *Teaching Thinking: Issues and Approaches*[141] (1990)
- "Teaching Thinking Dispositions: from Transmission to Enculturation"[142] (1993)

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[133] Jones, E.A., Hoffman, S., Moore, L.M., Ratcliff, G., Tibbetts, S. & Click, B.A.L. *National Assessment of College Student Learning: Identifying College Graduates' Essential Skills in Writing, Speech and Listening, and Critical Thinking. Final Project Report*, National Center on Post Secondary Teaching, Learning, and Assessment, University Park, PA, 1995, p. 167.

[134] Kelly-Riley, D., Brown, G., Condon, B. & Law, R. *Washington State University Critical Thinking Project*, The Center for Teaching, Learning, Technology, General Education & The Writing Programs, Pullman, WA, 2001, p. 4.

[135] Schaeffer, N.C. *Thinking and Learning to Think,* L. B. Lippincott Co., Philadelphia PA, 1901.

[136] Dewey, J. *How We Think,* D. C. Heath & Co., Chicago, IL, 1910 and Dewey, J. *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process,* 2nd ed., Regnery, Chicago, IL, 1933.

[137] Kirby, B.C. "Teaching to Think," *Journal of Education,* Vol. 116, No. 14, 1933, pp. 363-364.

[138] Anderson, H.C., Marcham, F.G. & Dunn, S.B. "An Experiment in Teaching Certain Skills of Critical Thinking," *Journal of Educational Research,* Vol. 38, No. 4, 1944, pp. 241-251.

[139] McPeck, J.E. *Critical Thinking and Education,* St. Martin's Press, New York, NY, 1981.

[140] Quellmalz, E.S. "Needed: Better Methods for Teaching Higher-Order Thinking Skills," *Educational Leadership,* Vol. 43, No. 2, 1985, pp. 29-35.

[141] Swartz, R.J. & Perkins, D.N. *Teaching Thinking: Issues and Approaches,* Midwest Publications, Pacific Grove, CA, 1990.

[142] Tishman, S., Jay, E. & Perkins, D.N. "Teaching Thinking Dispositions: From Transmission to Enculturation," *Theory into Practice,* Vol. 32, No. 3, 1993, pp. 147-153.

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An interest in teaching thinking continues to the present:

- "Learning to Think: the Challenges of Teaching Thinking"[143] (2005)
- *Education for Thinking*[144] (2005)

The majority of these books and articles proposed theoretical ways to teach thinking rather than reporting on how thinking has actually been taught. Examples of real world practices and results are included later in this report in the "Lessons Learned" section.

Numerous critical thinking textbooks are available for use at the college level. The majority of these textbooks focused on philosophy and logic as the primary vehicle for critical thinking, resulting in a less comprehensive perspective on critical thinking than I propose in this report. Although these textbooks include useful information, none are sufficient to teach the level and breadth of critical thinking needed by intelligence analysts. A sample of titles includes:

- *Critical Thinking: An Introduction to Logic and Scientific Method*[145] (1952, Philosophy/Logic)
- *Critical Thinking: a Functional Approach*[146] (1992, Psychology)
- *Thought & Knowledge: An Introduction to Critical Thinking*[147] (2003, Psychology)
- *Attacking Faulty Reasoning: A Practical Guide to Fallacy-free Arguments*[148] (2005, philosophy/logic)
- *Critical Thinking*[149] (2009, Philosophy/Logic)
- *Critical Thinking and Communication*[150] (2010, Communications)

A number of organizations are dedicated to helping infuse critical thinking into education. They include:

- Foundation for Critical Thinking (www.criticalthinking.org)
- National Center for Teaching Thinking (http://www.nctt.net/)
- Project Zero at Harvard University (http://pzweb.harvard.edu/)
- The Critical Thinking Company (http://www.criticalthinking.com/index.jsp)
- Association for Informal Logic and Critical Thinking (http://ailact.mcmaster.ca/)
- Robert Ennis' resources on critical thinking (http://www.criticalthinking.net/)

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[143] Ritchhart, R. & Perkins, D.N. "Learning to Think: The Challenges of Teaching Thinking," in *The Cambridge Handbook of Thinking and Reasoning*, eds. K.J. Holyoak & R.G. Morrison, Cambridge University Press, New York, NY, 2005, pp. 775-802.
[144] Kuhn, D. *Education for Thinking*, Harvard University Press, Cambridge, MA, 2005.
[145] Black, M. *Critical Thinking: An Introduction to Logic and Scientific Method*, 2nd ed., Prentice-Hall, New York, NY, 1952.
[146] Zechmeister, E.B. & Johnson, J.E. *Critical Thinking: A Functional Approach*, Brooks/Cole Publishing Co., Pacific Grove, CA, 1992.
[147] Halpern, D.F. *Thought and Knowledge: An Introduction to Critical Thinking*, Lawrence Erlbaum Associates, Mahwah, NJ, 2003.
[148] Damer, T.E. *Attacking Faulty Reasoning: A Practical Guide to Fallacy-Free Arguments*, 5th ed., Thomson/Wadsworth, Belmont, CA, 2005.
[149] Moore, B.N. & Parker, R. *Critical Thinking*, 9th ed., McGraw-Hill, Boston, MA, 2009.
[150] Inch, E.S. & Warnick, B. *Critical Thinking and Communication*, 6th ed., Allyn & Bacon, Boston, MA, 2010.

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Despite the long-term interest in infusing critical thinking into the K-12 and college educational systems, scholars and teachers have not yet agreed upon a consistent, widely used approach for accomplishing this objective. However, I did find isolated examples of success and report on these examples in the next section on lessons learned.

4.3.2. Lessons Learned About Training for Critical Thinking

Numerous publications have addressed the question of what can be learned from previous attempts to teach critical thinking. The settings that generated these lessons learned fall into one of three categories:

- General studies such as evaluations of how successful college critical thinking classes are in teaching transferable skills or studies of the impact of college on critical thinking skills
- Specific and controlled critical thinking training experiments such as done by Edward Glaser, Jennifer Reed, and several universities
- Findings from years of teaching critical thinking in the nursing profession

Results of General Studies: General studies report mixed results, with some describing successful outcomes and others reporting a lack of success. Several studies highlighted the challenge of teaching something and testing for it when the definition of the concept varies and when no agreed-upon instructional best practices or assessment mechanisms exist. Considering the conflicting definitions of critical thinking, the variety of skills and dispositions identified as supporting critical thinking, and the inconsistency in instructional approaches, the mixed results reported in the studies are not surprising.

Stephen Norris reported little evidence to support the effectiveness of critical thinking instruction in his 1985 research synthesis. He also highlighted the challenge of assessing the degree to which someone has learned critical thinking.

> There Is Little Detailed Knowledge About the Effectiveness of Teaching Critical Thinking.
>
> Research on the effectiveness of critical thinking instruction almost invariably uses indicators of effectiveness that are insensitive to fine details. The research typically concludes that instruction is effective (Annis and Annis, 1979; Frank, 1969; Moll and Allen, 1982; Ross and Semb, 1981; Wolf and others, 1968; Wright,' 1977; Yeazell, 1981). In these studies, and ones like them, classes of students experience a treatment designed to improve some aspect of their thinking ability. The treatments usually consist of a unit of work extending over a few weeks or as long as a year, and are based on the intuitions of the researchers about what ought to be effective instruction in thinking. The criterion for determining whether or not the treatment has a positive effect is often one of the general critical thinking tests mentioned earlier, or a test designed specifically for the study.
>
> Many of the studies do not use control groups, so special care must be taken when interpreting their results. Regardless of any specific limitations on the research design, however, two issues emerge. There is little, if any, evidence on the long-term impact of instruction in critical thinking, despite the fact that the vision of such impact is central to the justification of critical thinking instruction. In addition, while the conclusion of the studies is usually that instruction leads to better critical thinkers, we do not learn what

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> *specifically* makes these students better thinkers and in what *specific* ways they can still improve. Are they better thinkers because they have acquired a greater knowledge of principles of thinking, such as those proposed by Ennis, or because they tend to monitor more skillfully the progress of their own thinking, or because they have more completely adopted Siegel's critical spirit?[151]

Diane Halpern drew a different conclusion from a 2001 study:

> The Evidence
>
> Despite all of the difficulties in assessing gains in critical thinking, there is a diverse body of evidence showing that thinking can be improved with instruction that is specifically designed for that purpose. Although there has been some debate about whether it is possible to produce long lasting enhancement in the ability to think effectively (Block, 1985; Glaser, 1984; Resnick, 1983), we now have a considerable body of evidence that thinking-skills courses have positive effects that are transferable to a wide variety of situations. At least seven qualitatively different forms of outcome evaluations for thinking courses have been conducted, all of which are generally supportive of the idea that the ability to think critically can be improved as a result of thinking-skills instruction.
>
> While none of these constitute the "perfect measure," taken together they provide a substantial body of support for the value of thinking-skills instruction.[152]

Ernest T. Pascarella and Patrick T. Terenzini have completed a series of evaluations of the impact college has on students. One topic they address is how the overall college experience fosters critical thinking. They compared findings over time;[153] Table 11 summarizes their results. Note that these results come from different studies using different assessment methodologies.

Table 11: Critical Thinking Improvement of Upper Class Students Compared to Freshmen

Year	Critical Thinking Improvement
1991	1 standard deviation improvement of seniors to freshmen, giving a 34 percentile point advantage
1997	.54 standard deviation improvement of seniors to freshmen, giving a 21 percent advantage
1999	.37 standard deviation improvement of juniors to freshmen, giving a 14 percentile point advantage

Pascarella and Terenzini summarized their findings:

> Although change during college is quite often an inaccurate estimate of the actual impact of college, the evidence from the 1990s nevertheless suggests that students are making gains in critical thinking skills during college that are appreciably smaller in magnitude than the gains we observed in our previous synthesis. It is not readily apparent from the

[151] Norris, S.P. "Syntheses of Research on Critical Thinking," *Educational Leadership*, Vol. 42, No. 8, 1985, pp. 44-45.
[152] Halpern, D.F. "Assessing the Effectiveness of Critical Thinking Instruction," *Journal of General Education*, Vol. 50, No. 4, 2001, p. 277.
[153] Pascarella, E.T. & Terenzini, P.T. *How College Affects Students: A Third Decade of Research*, Jossey-Bass, San Francisco, CA, 2005, pp. 156-158.

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> evidence why this is the case. However, the more modest evidence of change in the 1990s does underscore an important point. Not all students develop as critical thinkers during college.[154]

Claudia María Álvarez Ortiz completed a meta-analysis of studies concerning the effectiveness of various approaches to teaching critical thinking. The primary question in her study was whether or not the study of philosophy improves critical thinking abilities. Her findings include:

> This meta-analysis gives us the best yet fix on the extent to which critical thinking skills improve over a semester of studying philosophy, general university study, and studying critical thinking. The meta-analysis results indicate that students do improve while studying philosophy, and apparently more so than general university students, though we cannot be very confident that this difference is not just the result of random variation. More importantly, studying philosophy is less effective than studying critical thinking, regardless of whether one is being taught in a philosophy department or in some other department. Finally, studying philosophy is much less effective than studying critical thinking using techniques known to be particularly effective such as LAMP.[155]

Richard Arum and Josipa Roksa conducted a multi-year, multi-institution study of college learning and published the results in 2011. Arum and Roksa noted the importance US higher education places on critical thinking while pointing out that the reality does not match the rhetoric. This concurs with what Jones and Kelly-Riley stated, as reported earlier in this document.

> Indeed, 99 percent of college faculty say that developing students' ability to think critically is a "very important" or "essential" goal of undergraduate education. 87% also claim that promoting students' ability to write effectively is "very important" or "essential."[12]
>
> However, commitment to these skills appears more a matter of principle than practice, as the subsequent chapters in this book document. The end result is that many students are only minimally improving their skills in critical thinking, complex reasoning, and writing during their journeys through higher education. From their freshman entrance to the end of their sophomore year, students in our sample on average have improved these skills, as measured by the CLA, by only 0.18 standard deviation.[13] This translates into a seven percentile point gain, meaning that an average-scoring student in the fall of 2005 would score seven percentile points higher in the spring of 2007.[156]

Arum and Roksa referred to the Pascarella and Terenzini studies of college learning and compare current learning with the amount students achieved in the past:

> How do we know that a 0.18 standard deviation does not represent remarkable growth? …Summarising an extensive body of research, Pascarella and Terenzini estimated that seniors had a 0.50 standard deviation advantage over freshmen in the 1990s. In contrast,

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[154] Pascarella, p. 158.
[155] Ortiz, C.M.A. *Does Philosophy Improve Critical Thinking Skills?* MA thesis, University of Melbourne, 2007, pp. ii-iii. Lots of Argument Mapping Practice (LAMP), refers to classes that include extensive practice rather than traditional lecture and testing. An example of critical thinking training with LAMP is described in the next section in the experiment conducted by Tim van Gelder.
[156] Arum, R. & Roksa, J. *Academically Adrift: Limited Learning on College Campuses,* University of Chicago Press, Chicago, IL, 2011, p. 35.

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during the 1980s students developed their skills at twice the rate: seniors had an advantage over freshman of one standard deviation.[157]

The general studies of growth in critical thinking identify two key findings:

- Non-specific interventions such as simply attending college do not result in strong growth of critical thinking abilities.
- The more specific the intervention, the stronger the outcome. As Ortiz reported, critical thinking classes resulted in stronger abilities than logic classes, and critical thinking classes with extensive practice had the strongest outcome of all.

The experiments described in the next section identify approaches that do successfully increase critical thinking abilities.

Critical Thinking Training Experiments: Several researchers wrote about specific experiments in teaching critical thinking, and all reported successful outcomes. The common success factors in these experiments include:

1. Identify a clear desired outcome – what is the improvement in critical thinking expected to accomplish?
2. Develop an understandable description of critical thinking that addresses the desired outcome and clearly describes needed competencies.
3. Design the program to specifically develop critical thinking competencies in the critical thinking description and that will enable the students to achieve the desired outcome.
    a. Topics, contents, and materials
    b. Teaching methodologies
    c. Opportunities for meaningful practice
    d. Faculty well trained in all of the above
    e. Consistent implementation by all faculty involved
4. Secure or develop an assessment that confirms that students learned what was intended and achieved the desired outcome.

Edward Glaser's *An Experiment in the Development of Critical Thinking* described the results of his work with school children. He defined his intended outcome, developed specific teaching materials and practices designed to achieve this outcome, conducted the experiment, and compared findings with those from a control group.

> The chief problems of this study are:
>
> 1. To develop and present materials and illustrative teaching procedures which may be used effectively by the teacher of upper-grade elementary, secondary, and college students to cultivate a spirit of inquiry and to stimulate growth in ability to think critically.
>
> 2. To evaluate the effectiveness of these materials and teaching procedures.
>
> 3. To ascertain whether or not there is a relationship between ability to think critically and certain other factors such as intelligence, reading ability, patterns of interest-values, home background, and sex, and to determine whether these factors are significantly

[157] Arum , pp. 35-36.

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associated with amount of gain on the critical thinking tests after receiving special instruction in critical thinking.[158]

The instruction consisted of eight topics supportive of critical thinking:

> There were eight lesson units in the original series developed for use by the teachers of the experimental classes. They were entitled:
>
> (1) Recognition of Need for Definition
> (2) Logic and the Weight of Evidence
> (3) The Nature of Probable Inference
> (4) Deductive and Inductive Inference
> (5) Logic and the Method of Science, and Some Characteristics of Scientific Attitude
> (6) Prejudice as a Factor Making for "Crooked Thinking,"
> (7) Values and Logic
> (8) Propaganda and "Crooked Thinking."[159]

Each unit included time in the classroom with lecture and practice as well as homework intended to enable the students to connect the concepts to daily life. Each unit also included "knowledge objectives" and "appreciation objectives" which we now call dispositions.

Glaser reported the following positive results:

> Conclusions:
>
> 1. The average gain (in composite Z-score) on the battery of critical thinking tests of the four experimental classes after ten weeks was significantly greater than the average gain of the four control classes on the same tests (diff./oa=6.09). This significant difference supports the conclusion that the lesson units which have been developed can be used effectively with high school (and probably college) students to stimulate growth in ability to think critically.
>
> 2. The improvement in ability to think critically appears to be somewhat general in character. There is evidence for some students of improvement in general disposition to consider problems thoughtfully, and evidence of ability to think more critically in other classes in school, at home, in connection with personal problems, and in connection with speeches, advertisements, and arguments. The aspect of critical thinking which appears most susceptible to general improvement is the attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experience. An attitude of wanting evidence for beliefs is most subject to general transfer.[160]

Donald Hatcher of Baker University described the approach an entire university took to improve critical thinking in its undergraduate students in "Critical Thinking and the Liberal Arts." Hatcher wrote a sequel that reported the results of the experiment in "Stand-alone Versus Integrated Critical Thinking Courses." Baker University established a cross-disciplinary team to develop a course required of all freshmen in order to improve their critical thinking and writing skills. The genesis of the project was a realization that students were ill-prepared to produce a

[158] Glaser, E.M. *An Experiment in the Development of Critical Thinking*, AMS Press Inc., New York, NY, 1941, p.8.
[159] Glaser, p. 94.
[160] Glaser, p. 175.

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senior capstone project, which required students to write a 15-20 page paper arguing for a specific public policy on a science, technology, or human values issue:

> The senior capstone began 1979. It was not long before those teaching the course realized that many Baker University seniors were seriously challenged, to put it mildly, when asked to write such a paper. The primary difficulty was that students did not understand how to construct or evaluate arguments. In 1988, a group of professors from the humanities began planning the freshman sequence with the goal of addressing this shortcoming.[161]

Hatcher served as project leader. He required the full collaboration and participation of other teachers in developing and delivering the program. This shared responsibility created challenges which took effort to overcome:

> In our attempts to create a new sequence, the main activities involved getting clear on what we wanted the course to accomplish (instruction in critical thinking and writing coupled with learning to read the classic texts). Once we were clear on this, we developed our own text to achieve our goals. The process of ten faculty writing a text was a trying, but ultimately fulfilling experience.[162]

Hatcher emphasized two important success factors: gaining agreement on the concept of critical thinking to be taught and verifying that the class does achieve the needed outcomes.

> First, it is never easy to achieve agreement in a group of faculty from different disciplines. Enthusiasm is not the same as "likemindedness." Anyone who desires to be a project director should be prepared for confrontational situations. Second, from the beginning each participant must be willing to compromise or change a position in light of new arguments. Third, because projects seldom progress on schedule, it is better in program development to plan for at least two years with ample time for theoretical discussions, trial runs, and revisions. Only through running trial semesters for three semesters were we able to determine what approaches and reading worked best.[163]

Hatcher's analysis of what was accomplished after sixteen years of experience is equally interesting. He emphasized the importance of a common understanding of critical thinking.[164]

> For those who worked on the project, getting clear on exactly what is meant by *critical thinking* was the first task. As previously noted, one's specific conception of critical thinking will influence greatly both the structure and the content of the courses. The group examined some of the standard definitions and was not completely comfortable with any of them (Hatcher, 2000). It was important that the definition be as clear and concise as possible, so that both those planning the courses and the unconvinced among the faculty would know what was being discussed when the new sequence was proposed as a part of Baker's General Education Program and required of all freshmen. The definition should make it easy to see why critical thinking is an important educational goal. It should also refer specifically to the criteria to be used for critical judgment. Otherwise, there will never be agreement over what counts as a "reasonable position." It

[161] Hatcher, D.L. "Stand-Alone Versus Integrated Critical Thinking Courses," *Journal of General Education,* Vol. 55, No. 3-4, 2006, p.250.
[162] Hatcher, D.L. *Critical Thinking and the Liberal Arts,* Baker University, Baldwin City, KS, 1990, pp. 5-6.
[163] Hatcher, p. 6.
[164] The Baker University definition of critical thinking was included in section 4.1.2.2 of this report.

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should allow people to distinguish critical thinking from other cognitive activities such as creative thinking, problem solving, and logical inference.[165]

Baker University took a unique approach to developing the content of the program, choosing to include minimal theory with a greater emphasis on applying the theory through extensive practice during a two-course sequence. This approach supports what Ortiz found in her meta-analysis.

> Only three to four weeks are spent, an unusually brief time compared with even one-semester critical thinking courses, studying deduction, induction, and a few of the more common informal fallacies. The final weeks of the semester provide instruction in how these logical tools can be applied when writing papers. With minimal instruction, students can use some of the standard argument patterns, such as *modus ponens*, *modus tollens*, disjunctive syllogism, or some combination of these, to construct and evaluate arguments in support of positions they might defend in a paper.[166]

> These two courses differ from traditional critical thinking courses insofar as they focus on the use of formal logic and CT skills to argue for and critique positions in student papers. Throughout the two semesters, the time spent on writing, approximately 80%, far exceeds the time spent on instruction in the logical tools necessary to evaluate ideas critically. They differ from traditional written composition courses insofar as they emphasize only one type of paper— the argumentative essay.[167]

Although the articles imply that performance on the senior capstone project improved, the reports from Hatcher did not explicitly identify or quantify these improvements. Rather, the reports identified improvements as measured by standardized critical thinking assessments. Baker University used a variety of assessments to determine whether the students did further develop their critical thinking skills. All assessments over 15 years' experience indicated significant improvement in critical thinking skills. The results of the study exceeded what could be expected from a typical college experience. The results from Baker University are more significant than those reported by Pascarella & Terenzini and by Arum & Roksa.

> As Table 1 indicates, the average effect-size gains by the Baker students are significantly higher (+1.47).[168]

Jennifer Reed conducted an experiment to teach critical thinking as part of history classes. As with Glaser, Reed had a clear understanding of what outcomes she wanted to achieve and how she planned to achieve them.

> Statement of the Problem:
>
> This study investigated the effect of integrating Richard Paul's model for critical thinking into a U.S. history course on community college students' 1) abilities to think critically about U.S. history and about everyday issues, 2) dispositions toward thinking critically,

[165] Hatcher, D.L. "Stand-Alone Versus Integrated Critical Thinking Courses," *Journal of General Education,* Vol. 55, No. 3-4, 2006, pp. 250-251.
[166] Hatcher, p. 253.
[167] Hatcher, , p. 254.
[168] Hatcher, p. 255.

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and 3) knowledge of history content. This study also examined if age (under 22, 22 and older) or gender moderated the effectiveness of the instructional method.[169]

The major findings of this study can be summarized as follows:

Community college students' abilities to think historically and to think critically can improve in a single course when provided with explicit and intensive training.

Community college students' end of term knowledge of history content need not suffer when explicit training in critical thinking abilities has been integrated into course material.[170]

Reed also noted that her experiment had no impact on thinking dispositions.

To test students' dispositions toward critical thinking, students in both groups took the CCTDI during the first two weeks of the course and again during the last week of the course. Results from statistical analyses of the scores on this instrument showed no significant differences between the experimental and control groups. Further, posttest means were not significantly different from pretest means in either group (Pretest: Experimental M = 296, Control M = 297; Posttest: Experimental M = 298, Control M = 302). It appears that taking a single history course that includes explicit instruction in Paul's model but does not emphasize intellectual traits of the critical thinker has no effect on students' dispositions toward critical thinking.[171]

Tim van Gelder wrote about improvements in results from a college critical thinking class when automated argument mapping software is part of the program. Van Gelder tested the theory of *quality practice* using a software tool called Reason!Able. Reason!Able assists with developing and evaluating arguments, which provides practice in interpretation, analysis, evaluation, and inference skills.

Reviewing the research literature on cognitive skill acquisition, we found a consensus around the unsurprising idea that cognitive skills, like other skills, improve with practice. However, it must be the right kind of practice. Generically, the practice should be

- *Motivated* – the student should be deliberately practicing in order to improve skills
- *Guided* – the student should have some way of knowing what to do next
- *Scaffolded* – particularly in early stages, there should be structures preventing inappropriate activity
- *Graduated* – tasks should gradually increase in complexity
- *Feedback* – the student should have some way of telling whether a particular activity was successful or appropriate[172]

From the outset we have been aiming to develop an approach to critical thinking instruction that *demonstrably* produces *substantial* gains. (A further constraint is that the

---

[169] Reed, J.H. *Effect of a Model for Critical Thinking on Student Achievement in Primary Source Document Analysis and Interpretation, Argumentative Reasoning, Critical Thinking Dispositions, and History Content in a Community College History Course*, Ph. D. dissertation, University of South Florida, 1998, p. xi.
[170] Reed, p. 160.
[171] Reed, p. 150.
[172] van Gelder, T. "How to Improve Critical Thinking Using Educational Technology," *Meeting at the Crossroads: Proceedings of the Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE 2001)*, Melbourne, Australia, 9-12 December 2001, p. 540.

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approach be practical and affordable for widespread use.) The new approach is the Reason! method, which essentially just implements the QPH with Reason!Able as the practice environment.[173]

Results:

Data is available for studies conducted in both 2000 and 2001. The two studies yielded essentially the same results. The CCTST indicated improvement with an effect size of about 0.84 (mean difference between paired pre- and post-test scores, divided by standard deviation on the pre-test). The written test showed effect sizes of a similar order of magnitude, though there were substantial differences and low correlations between scorers. Collectively these results indicate that the effect is quite robust. Crudely speaking, we are seeing a gain in critical thinking of the best part of one SD in a single semester. (For comparison, an equivalent shift in IQ would be about 12-13 points on average across the group.)[174]

All of these examples demonstrate that a well-designed approach to teaching critical thinking can improve students' critical thinking performance.

***Findings from Years of Teaching Critical Thinking in Nursing Programs**:* The nursing profession embraced critical thinking as a key skill for nurses. As a result, education for critical thinking in nursing has been extensively studied. Numerous articles about critical thinking as applied to nursing described what has been learned from over a decade of emphasis on critical thinking as an essential outcome of nursing education.

It is not clear that this emphasis on critical thinking has had a significant impact on measurable critical thinking ability. Some of the reasons for this lack of results include:

- Lack of a nursing-specific definition and conception of critical thinking
- Lack of a consistent understanding of how to apply critical thinking concepts to nursing
- Lack of effective, consistent teaching approaches and methods.
- Multiple assessment methods that do not demonstrate what has been learned effectively and that are not specific to nursing

A 1998 study of critical thinking in nursing education noted:

> In nursing education, critical thinking is not a clearly understood concept, nor is it systematically applied.[175]

Sharon Staib conducted an analysis of studies about teaching and assessing critical thinking in nursing in an attempt to identify effective teaching strategies. The article included mention of a Delphi process conducted in 2000 to define critical thinking specifically for nursing. This effort resulted in the following definition:

> Critical thinking is an essential component of professional accountability and quality nursing care. Critical thinkers in nursing exhibit these habits of the mind: confidence, contextual perspective, creativity, flexibility, inquisitiveness, intellectual integrity,

[173] van Gelder, p. 545.
[174] van Gelder, p. 546.
[175] Myrick, F. *Preceptorship and Critical Thinking in Nursing Education*, Ph.D. dissertation, University of Alberta, 1998, p. 23.

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> intuition, open-mindedness, perseverance, and reflection. Critical thinkers in nursing practice the cognitive skills of analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting and transforming knowledge.[176]

Staib's study[177] demonstrated the danger of calling for the inclusion of a topic into a national curriculum without adequate advance preparation. Staib compiled a table, shown in Figure 4, summarizing studies of critical thinking teaching strategies, goals, assessments, and results. She found:

- Wide variety of teaching strategies (journaling, students interviewing mothers about their birth experience, case studies, concept maps, and more)
- Limited content addressed in the teaching. Of the ten habits identified in the consensus definition above, none of the training programs addressed all of the habits. Two programs addressed four of the habits, while the remaining programs addressed between zero and three.
- Multiple assessment methods (formal CT assessments, anecdotal/self report)

[176] Norris, S.P. & Ennis, R.H. *Evaluating Critical Thinking*, Midwest Publications, Pacific Grove, CA, 1989, p. 499.
[177] Staib, S. "Teaching and Measuring Critical Thinking," *Journal of Nursing Education*, Vol. 42, No. 11, 2003, pp. 500-501.

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TABLE
Summary of Studies Using Critical Thinking Strategies

Author	Method	Goal	Evaluation Method	Results	Critical Thinking "Habits of the Mind" Addressed
Baker (1996)	Journaling	To help students identify their own cognitive and affective behavior during nursing practice	—	—	Reflection
Bell et al. (2002)	Six-step, process-focused group learning strategy	To teach students how to conduct in-depth analyses of clinical incidents that caused them to use critical thinking	Anecdotal	Students appeared to strengthen theoretical and experiential knowledge.	Reflection, creativity, open-mindedness
Callister (1996)	Students interviewed their own mothers about their birth experience	To foster critical thinking in the cognitive and affective domains	Anecdotal	Student and faculty reported an increase in critical thinking.	Reflection, contextual perspective
Daley et al. (1999)	Concept maps	To increase critical thinking by helping students identify and draw relationships between concepts	• Evaluated knowledge acquired during the semester • Statistical comparison of first concept map to third concept map • Anecdotal	Statistically significant difference between the first and third maps was found. Students liked the method but thought it was time consuming. Faculty thought the maps demonstrated students' knowledge.	Contextual perspective, creativity
Eerden (2001)	Critical thinking vignettes	To teach critical thinking skills in a controlled laboratory environment that simulates the complexity of clinical nursing situations	Anecdotal	Favorable faculty response.	Confidence, contextual perspective
Jenkins & Turick-Gibson (1999)	Role playing	To increase students' awareness of the effects of disease on the life of someone living with the disease	Anecdotal	Students' journals showed critical thinking through problem solving during their experience.	Contextual perspective, creativity
Jones & Sheridan (1999)	Case study	To provide novice nurses with a chance to make decisions, apply knowledge, and examine beliefs in a safe setting	Learners' participation was evaluated during the activity using a clinical competence checklist and a qualitative evaluation summary.	—	Open-mindedness, creativity
Krejci (1997)	Imagery	To stimulate students to think about the images that appear in response to terms common to nursing	Anecdotal	Positive feedback from students	Contextual perspective, open-mindedness
Mottola & Murphy (2001)	"Antidote Dilemma," an interactive group activity to solve a nursing care dilemma	To teach students how to "practice thinking," then think about and evaluate the thinking process	Anecdotal	Authors believed thinking about factors students had not considered in their own solution to the dilemma was most valuable in teaching critical thinking.	Reflection, open-mindedness

Figure 4: Summary of Critical Thinking Teaching Techniques, Topics Covered, Assessment Methodologies, and Results in Nursing Education

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TABLE (Continued)
Summary of Studies Using Critical Thinking Strategies

Author	Method	Goal	Evaluation Method	Results	Critical Thinking "Habits of the Mind" Addressed
Perciful & Nester (1996)	CAI	To determine the effect on students' knowledge and critical thinking of CAI vs. clinical experience	Critical thinking was measured using two parts of the NLN Psychiatric Nursing Examination. Knowledge was measured using two other parts of NLN Examination and the Mosby AssessTest.	CAI students scored higher on the NLN Examination (i.e., critical thinking). No statistically significant difference in knowledge was found between the groups.	Creativity, contextual perspective, flexibility
Rossignol (1997)	Discourse strategies	To compare effectiveness of five strategies: teacher high-level questions, teacher elaboration of student ideas, teacher probing questions, student participation, and student-to-student participation	WGCTA scores	Inconsistent, small positive relationship was found between high-level teaching questions and critical thinking. Large inverse relationship was found between student participation and critical thinking.	—
Russaw (1997)	Personally perceived problem technique	To have students identify personal learning needs, work through these needs, and identify future improvements	—	—	Inquisitiveness, flexibility, creativity
Saucier et al. (2000)	CAI vs. nursing process	To compare the effect of CAI and written case studies strategies on nurse practitioner students' critical thinking abilities	CCTST	No significant increase in critical thinking occurred using either method.	Creativity, flexibility, contextual perspective
Schumacher & Severson (1996)	Critical thinking rounds	To facilitate continuing development of critical thinking by nurses and create a dialogue among various levels of nurses and students	Anecdotal	Nurses and students reported a "therapeutic" effect.	Open-mindedness, creativity
Sorrell et al. (1997)	Interdisciplinary written assignments and portfolios	—	—	—	—
Todd (1998)	E-mailed multiple-choice questions. Students reported their rationale for selection of correct and incorrect responses.	To increase student participation in learning and increase student-teacher interaction	Students completed a questionnaire at the end of the course.	Most students responded that they felt the exercises using e-mail were useful and improved their critical thinking, and recommended future use.	—

Note: CAI = computer-assisted instruction; CCTST = California Critical Thinking Skills Test; NLN = National League for Nursing; WGCTA = Watson-Glaser Critical Thinking Appraisal.

Figure 4: Continued… Summary of Critical Thinking Teaching Techniques, Topics Covered, Assessment Methodologies, and Results in Nursing Education

In a longitudinal study at a single institution, Catherine M. Walsh and Lisa A. Seldomridge analyzed teaching strategies and results over multiple years. They reported:

> Although demonstrating modest gains in critical thinking dispositions by some cohorts, data collected from 1997 to 2002 showed no consistency of pattern. While some cohorts saw gains, subsequent cohorts saw losses, and several years had essentially no change. Throughout this period, the usual academic indicators (e.g., Scholastic Aptitude Test

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(SAT)/American College Test (ACT) data, cumulative grade point average, science grades) remained the same. The data on critical thinking skills were likewise inconclusive and difficult to explain. This raised concerns about both the definition of critical thinking and the utility of using standardized instruments to measure critical thinking.[178]

Walsh and Seldomridge noted the lack of correlation between performance on a test and actual job performance:

> The use of standardized instruments to measure critical thinking skills is not particularly useful because such tools assess the skills of classical logic, as opposed to the critical thinking skills of clinical practice. There is a substantial disconnect between critical thinking assessments and sought-after clinical skills.[179]

They also highlighted the challenge of teaching a subject when it is not well understood:

> Other than fact acquisition, pedagogical interventions and strategies to boost critical thinking have been largely unproven, ineffective, or of unknown utility because we, as nurse educators, have little understanding of the specific types of reasoning we are trying to cultivate.[180]

Summary of Lessons Learned: The long term analyses from the nursing profession and critical thinking experiments summarized as lessons learned in this section clearly identify success factors and obstacles to developing critical thinking abilities. The factors that contribute to effective teaching as discerned from the studies include:

- Clarity and agreement about what critical thinking is and what students should be able to do
- Common use of effective teaching strategies that focus on and support the definition of critical thinking
- Opportunities for meaningful and extensive practice that reinforce all aspects of critical thinking
- Addressing the totality of the definition of critical thinking in the program
- Including an effective means of assessment to test what had been learned
- Focus on continuous improvement

The factors that hinder effective teaching include:

- Treating critical thinking as a buzzword – just using the term rather than explicitly teaching thinking skills
- Not having or not following a clear definition and description of critical thinking; not clarifying what a student who thinks critically will be able to do
- Using teaching strategies that are not connected with critical thinking, such as having students keep a journal, as a way to foster critical thinking

[178] Walsh, C.M. & Seldomridge, L.A. "Critical Thinking: Back to Square Two," *Journal of Nursing Education*, Vol. 45, No. 6, 2006, pp. 212-213.
[179] Walsh & Seldomridge, p. 216.
[180] Walsh & Seldomridge, p. 216.

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- Not using standard teaching strategies or letting instructors develop their own strategies and approaches
- Limited or no opportunity for explicit practice
- Inability to assess the degree to which the students met the expectations for thinking critically

4.3.3. Critical Thinking Training Courses

In this section of the report, we examine actual training courses designed for adult learners and intended as post-college professional development experiences. I secured a number of critical thinking course descriptions and syllabi in order to evaluate the course content. These examples include both public courses with open enrollment and courses specifically developed for the intelligence community.

Public Courses with Open Enrollment: I found multiple providers of public courses, each with its own model of critical thinking, differing topics of focus, and widely differing amounts of time allotted to the training experience. When comparing these courses against the success factors identified in the critical thinking training experiments section of this report (Section 4.3.2.), none meet all criteria. A sample of three public courses is included in this report to illustrate typical content and teaching approach.

Foundation for Critical Thinking – The majority of workshops provided by the Foundation are focused on teaching K-12 teachers how to include critical thinking in the classroom. However, they also offer a series of five two-day workshops on specific aspects of critical thinking for business and professionals. The Foundation model for critical thinking is shown in Figure 5.[181]

[181] "The Critical Thinking Community," Foundation for Critical Thinking. Available: http://www.criticalthinking.org/starting/index.cfm, Viewed: 19 April 2010.

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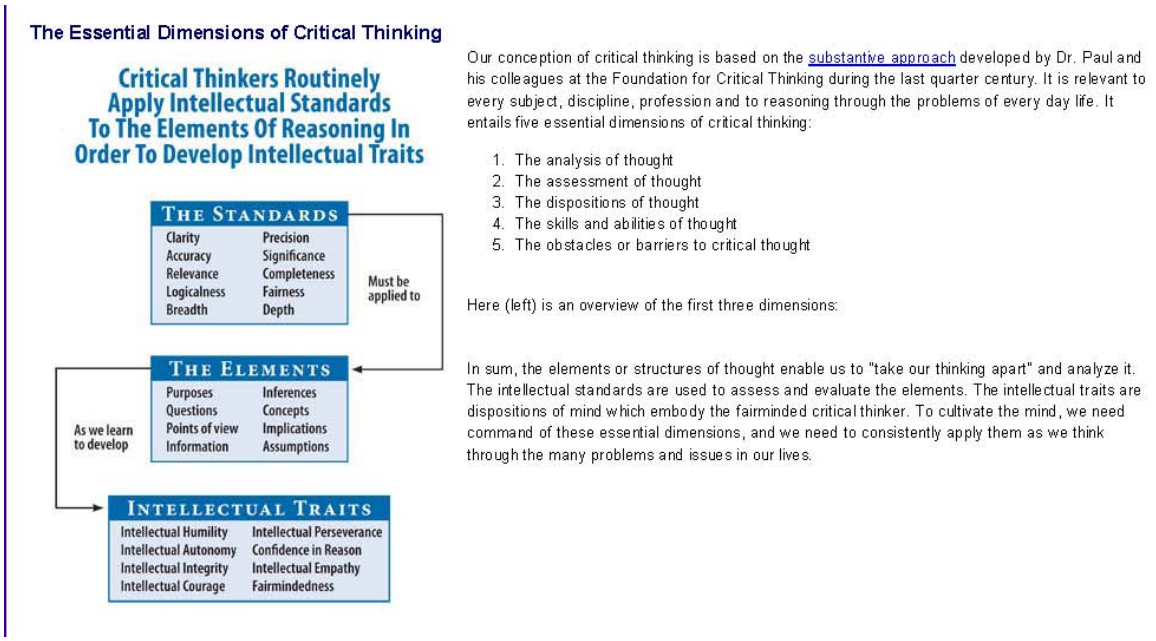

Figure 5: Foundation for Critical Thinking Model of Critical Thinking

The business and professional course descriptions are:

- **Recognizing the Importance of Critical Thinking in Business**. This seminar focuses on introducing the foundations of critical thinking, including how to take your thinking apart and assess it for quality, and how to apply critical thinking concepts and principles to your work on a daily basis.
- **Using the Tools of Critical Thinking to Make Better Decisions**. This seminar focuses on deepening your understanding of the concepts and principles of critical thinking and applying them to decision-making at work.
- **Understanding the Barriers to Critical Thinking**. This seminar focuses on the natural workings of the human mind that impede our ability (as humans) to reason at the highest level of quality.
- **Learning the Art of Analysis**. This seminar expands on the elements of reasoning that were introduced in the first seminar. You will be in engaged in many activities focused on analyzing reasoning in numerous everyday work situations - both your own reasoning as well as the reasoning of others.
- **Learning the Art of Assessing Thought**. This seminar expands on the introduction of intellectual standards for thought which were introduced in the first seminar. You will learn how to apply these standards to your thought and in your work at all levels. You will also learn to apply these standards to the reasoning of others. [182]

[182] "The Critical Thinking Community," Foundation for Critical Thinking. Available: http://www.criticalthinking.org/professionalDev/business.cfm, Viewed: 28 April 2011.

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Of the public courses featured in this section of the report, the courses presented by the Foundation for Critical Thinking appear to provide the most depth and the most opportunities for practicing critical thinking skills.

HeadScratchers LLC – HeadScratchers is an organization specializing on providing critical thinking training for business professionals. They offer one and two day introductory critical thinking workshops. The HeadScratchers critical thinking model is shown in Figure 6.[183]

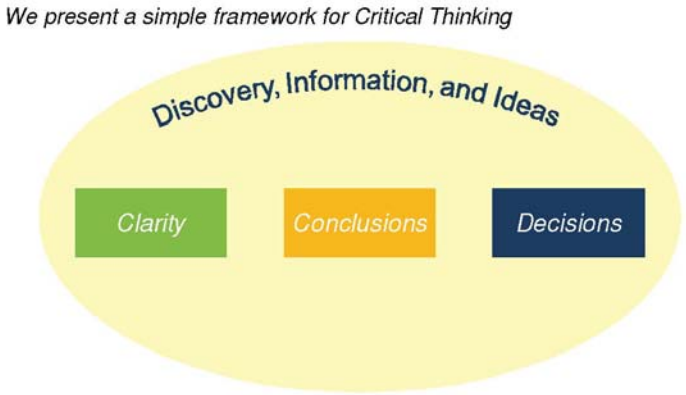

Figure 6: HeadScratchers Model of Critical Thinking

The objectives for the foundational course are:

- Apply the three- step Critical Thinking Process to Problem Solving and Decision making.
- Apply critical thinking to Get Clear on a Problem or Decision aided with the Clarity Thinksheets
- Use the Conclusion Thinksheets to guide and document your thinking for Conclusions
- Use the Decision Thinksheets to guide and document your thinking for Decisions.
- Implement your next step plan (created in the workshop) and report how your thinking has changed.[184]

Pearson - Pearson now owns the rights to the Watson-Glaser Critical Thinking Assessment (WGCTA). Pearson offers two versions of critical thinking training. The first is called Critical Thinking Boot Camp, which includes completing the WGCTA prior to participating in a two-day workshop. The second Pearson offering is called Critical Thinking University. This course consists of a series of 18 one-hour online sessions. The Pearson model for critical thinking is shown in Figure 7.[185]

[183] Anonymous. *Critical Thinking for Problem Solving, Decision Making and Creativity [Workshop Brochure]*, Headscratchers LLC, Greenwood Village, CO, [undated].
[184] Anonymous. *Critical Thinking for Problem Solving, Decision Making and Creativity [Workshop Brochure]*, Headscratchers LLC, Greenwood Village, CO, [undated].
[185] Watson, G. & Glaser, E.M. *Watson-Glaser II Critical Thinking Appraisal Technical Manual and User's Guide,* NCS Pearson, Inc., San Antonio, TX, 2009, p. 2.

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Figure 7: Pearson Model of Critical Thinking

The course objectives for the two-day Critical Thinking Boot Camp are:

- Define critical thinking
- Identify your own critical thinking strengths and opportunities
- Overcome barriers to thinking critically
- Learn the critical questions to be asked in any situation that requires focused attention
- Utilize tools and techniques for accurately identifying the root cause of a problem, strategically analyzing complex issues, making effective decisions, and anticipating problems in implementation
- Create a plan of action to make a tangible, positive impact in your organization [186]

Open enrollment classes are designed for broad audiences in hopes of attracting a large number of participants. They do not include industry specific information for any particular profession. In the next section of the report I review the classes developed for intelligence analysis professionals.

Critical Thinking Training in the IC: The documents I reviewed related to critical thinking training for intelligence analysis included course outlines or syllabi, course manuals, curriculum descriptions, and individual course descriptions. The primary sources of critical thinking training are organizations within the intelligence community. However, I also reviewed a sample of college courses if they were part of the curriculum for an intelligence analysis degree.

I found the following in the intelligence analysis course materials:

- Little commonality between courses – materials, topics, and depth are different in different courses.
- A simplistic approach to critical thinking; little focus on cognitive skills and dispositions; frequent mention of critical thinking without substance behind the topic; or including critical thinking as one of many topics.
- Writing about critical thinking and structured analytic techniques as though these are related or the same thing.
- A strong focus on avoiding bias, as though the absence of bias results in critical thinking.

[186] Anonymous. *Critical Thinking Boot Camp [Course Brochure]*, Pearson Education Inc. 2009, p. 2.

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David Moore described a 40-hour critical thinking course in *Critical Thinking and Intelligence Analysis*:

> This critical thinking and analytic problem-solving course offers participants a chance to learn a paradigm for critical thinking and critically explore different structured methods of analysis. Texts by critical thinking experts Richard Paul and Linda Elder, and structured analysis experts Morgan Jones and Richards Heuer, as well as materials developed by the instructor, teach the concepts and techniques. Classroom problems as well as operational examples (introduced and developed by the students from their own work) reinforce and help transfer what is learned into the operational environment. A final project developed by student teams completes the formal requirements.[187]

The course objectives are:

- Use critical thinking techniques to provide structure to your analytic reasoning.
- Identify, describe, and employ 14 methods for structured reasoning.
- Demonstrate critical thinking proficiency through lecture, classroom participation, and weekly homework assignments.
- Complete a final class assignment using a minimum of five structured analytic methods presented in this course.
- Apply knowledge of critical thinking by using a set of analytic tools designed to hone your skills as an analyst.[188]

Bruce Bennett described the Defense Intelligence Strategic Analysis Program in Defense Intelligence Agency's (*DIA) Analytic Competency-Based Training*. The Strategic Analysis Program identified critical thinking as one of five core competencies. The document described four courses that addressed critical thinking. The two descriptions included here are representative of the course offerings:

- **Fundamentals of Intelligence Analysis (FIA).** FIA is a four-week in-residence course designed for newly-assigned analysts in the National Capital Region. Students enter a training pipeline that begins with DIA orientation (Gateway), and continues with Tomorrow's Intelligence Professionals, a course designed to educate new employees about the basics of intelligence, the agency, and how it fits into the intelligence and defense communities. Next, the Office of the Director of National Intelligence's Fundamentals of Analysis provides a thorough orientation within the IC. Finally, FIA offers a hands-on practical application of critical thinking, collaboration, structured analysis, analytic writing, problem solving, and briefing skills.
- **Critical Thinking and Structured Analysis (CTSA).** CTSA is an eight-session course designed to provide the existing non-Combatant Command (COCOM) workforce that did not attend FIA with critical thinking skills and a solid understanding of structured analytic methodologies. This course was designed to

[187] Moore, D.T. *Critical Thinking and Intelligence Analysis*, Joint Military Intelligence College, Washington, D.C., 2006, p. 98.
[188] Moore, p. 99.

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ensure that FIA graduates and their new skills would be accepted by the existing workforce.[189]

A 2008 course titled *Analysis 101* included a focus on critical thinking. The vision for *Analysis 101*, also called *Introduction to Critical Thinking and Structured Analysis*,[190] was described as:

> Analysis 101 is an unprecedented program of joint training in rigorous critical thinking and intelligence skills for all analysts during their initial months in the IC.
>
> This four-week course provides instruction on critical thinking for analytic success and the role of analysis in the complex, evolving world of intelligence. Working closely with peers from other agencies, new analysts acquire a common set of analytic skills and a joint perspective on the intelligence profession. The course helps fulfill one of the Office of the Director of National Intelligence's (ODNI) central missions - creating an integrated IC.[191]

The course goals are:

> Improve the analytic abilities of IC analysts by:
>
> – Providing participants from across the Community a common foundation of critical thinking and analytic skills
> – Familiarizing participants with methodologies and other tools that facilitate critical thinking and problem solving
> – Educating new analysts about how they (and their respective organizations) fit into the overall IC mission[192]

The National Defense Intelligence College Catalog 2009-2010 stated that the overall program integrates core skills and competencies such as critical thinking throughout the curriculum. The description below is representative of the course offerings.

> **MSI 607 Intelligence Reasoning and Analysis** (3:3:0)
>
> This course focuses on art and science of analysis and explores the methodologies and processes of developing effective intelligence analysis. The course orients itself on the ODNI Analytical Standards that the IC employ analysis of alternatives, and conduct effective professional collaboration. Students will explore the elements of logic, critical thinking, and argumentation as the fundamental components of assessing and estimating threats and opportunities in the national security environment. Students will then examine analytical methodologies with the goal of mitigating traditional analytic pitfalls and enhancing the accuracy of assessments. Throughout the course, the class will explore the numerous organizational and ethical issues associated with improving intelligence analysis in today's highly dynamic and increasingly complex environment.[193]

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[189] Bennett, B. "DIA's Analytic Competency-Based Training," *American Intelligence Journal*, Vol. 26, No. 2, 2008/2009, p. 28.
[190] Immerman, R.H. "Transforming Analysis: The Intelligence Community's Best Kept Secret," *Intelligence and National Security*, Vol. 26, No. 2-3, 2011, p. 168.
[191] Anonymous. *Analysis 101. Participant Guide* 2008, p. 3.
[192] Anonymous. *Analysis 101. Participant Guide* 2008, p. 4.
[193] Anonymous. *National Defense Intelligence College. Academic Year 2009-2010*, National Defense Intelligence College, Washington, D.C., [undated], p. 84.

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To provide additional examples of the kinds and quality of courses available to the intelligence community, I have included a selection of courses in support of the National Air and Space Intelligence Center (NASIC) at Wright-Patterson Air Force Base in Ohio. These courses include professional development offered at NASIC, a course from the Advanced Technical Intelligence Center (ATIC), and courses at Sinclair Community College and Clark State Community College, which support the ATIC degree program.

NASIC held a two-day course entitled *Critical Thinking* in March 2010. This course had a strong emphasis on the thinking skill of inference and on argument evaluation:

> **COURSE OVERVIEW**:
>
> Critical thinking is a core skill of the educated person and an even more important skill for intelligence analysts. An essential part of critical thinking is the ability to evaluate the quality of the support for inferences - their own and those of others. Much of the evaluation of inferential support in the intelligence community today comes down to the evaluation of sources - is the source credible, objective (unbiased), etc.? While source evaluation is absolutely necessary, even biased sources sometimes provide useful information and apparently unbiased ones sometimes do not. Therefore, this course narrows the scope of critical thinking to evaluating the support for inferences directly given the text provided regardless of the source. It does not replace source evaluation, but it is complimentary to it. [194]
>
> **COURSE OBJECTIVES:**
>
> Upon successful completion of the course, students will be able to:
>
> a. Identify the elements of an argument used to support an inference, particularly the main idea (the inference itself) and the evidence (facts and reasoning) used to support the inference.
> b. Identify the assumptions (warrants) required to use that evidence in support of that inference.
> c. State alternatives those assumptions and any evidence or reasons that the alternative assumptions might be true.
> d. Judge the overall quality of support for the original main idea based on the plausibility of the alternative assumptions
> e. Modify the main idea, if advisable and possible, to take any plausible alternative assumptions into account.
> f. Work with others in a skillful manner to arrive at a consensus for items a through e.
> g. Present the findings of that team work in a clear, concise and cogent manner.[195]

ATIC offers a two-day course called *Critical Thinking Skills* as one component of the Analyst Boot Camp. It can also be attended as a stand-alone course.

[194] Anonymous. *Critical Thinking. Course Syllabus*, NASIC, Wright-Patterson AFB, OH, 2010, p. 1.
[195] Anonymous. *Critical Thinking. Course Syllabus*, NASIC, Wright-Patterson AFB, OH, 2010, pp. 2-3.

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Course Description

The Critical Thinking Skills course introduces the IC and other professionals to thought and reasoning processes. Students learn about biases, prejudices, and fallacies which hinder the thought process and how to avoid them. This course develops the necessary skills to provide innovative solutions to threats never before encountered.

What You Will Cover

- Conceptualize, apply, analyze, synthesize, and evaluate information
- Apply unbiased reasoning and logic
- Analyze situations from both the US and adversarial points of view
- Students analyze a current event and give a presentation[196]

Sinclair Community College and Clark State Community College offer Certificate and Associate degree programs for intelligence analysis. Neither school requires critical thinking coursework during the certificate program,[197] but both do for the Associate degree.[198] The critical thinking courses provided by both institutions appear to be standard philosophy-based logic courses.

The limited amount of practice usually provided in existing intelligence analysis courses was noted by Tecuci et al. in their article describing a proposed tool for teaching critical thinking called Teaching Intelligence Analysts Critical Thinking Skills (TIACRITIS). The authors did not propose a specific course. Instead, they recommended incorporating TIACRITIS and its textbook into existing training courses to add effective practice opportunities. In describing the need for this tool, the authors highlighted problems with existing training:

> Based on our years of experience in training intelligence analysts, law students, and high-ranking military officers, we have arrived at the following conclusions related to the training of intelligence analysts. The first is that training in the evidential reasoning tasks required in these and other important contexts cannot be learned effectively just by listening to someone discuss his/her own analyses, or just by giving students lectures and assigned readings on the topics. What is absolutely necessary is regular practice involving analyses of evidence using either hypothetical situations or examples drawn from actual situations. In short, evidential analysis is mastered best by performing analyses contrived to illustrate the wide variety of subtleties or complexities so often encountered in actual evidential analyses.
>
> Our second conclusion is based on our inspection of the materials offered in several courses for training intelligence analysts. It appears that analysts are so often trained in the production of intelligence analyses rather than upon the actual process of analysis

[196] Anonymous. *Course Description - Training: Critical Thinking Skills*, Advanced Technical Intelligence Center, Beavercreek, OH, 2010, p. 1.
[197] "Advanced Technical Intelligence Certificate," Clark State Community College. Available: http://www.clarkstate.edu/programdetails.php?Program=120, Viewed: 22 March 2010 and "Advanced Technical Intelligence Certificate Overview," Sinclair Community College. Available: http://www.sinclair.edu/components/bulletin/bulletin.cfc?method=displa, Viewed: 22 March 2010.
[198] "Advanced Technical Intelligence," Clark State Community College. Available: http://www.clarkstate.edu/programdetails.php?Program=4, Viewed: 22 March 2010 and "Advanced Technical Intelligence Degree," Sinclair Community College. Available: http://www.sinclair.edu/components/bulletin/bulletin.cfc?method=displa, Viewed: 22 March 2010.

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itself. Very little training is offered regarding the properties, uses, discovery, and marshaling of the evidence upon which all analyses rest.[199]

Some of the course descriptions I reviewed mentioned projects or case studies as final activities that would demonstrate the learning that took place during the course. However, I found no information describing the impact of the training on the analysts as demonstrated by these projects or on their subsequent analytic performance.

The lack of consistent understanding of what critical thinking is and how to apply it is demonstrated in the wide variation in course content, topics, depth, and specific skills taught. An analyst can attend one of these and believe that he or she is trained in critical thinking, yet have a fundamentally different understanding of critical thinking than attendees of other courses. If critical thinking is as important as it appears to be from its inclusion in intelligence community governing documents, it is important that analysts receive training focused on common skills in order to develop common competencies.

4.3.4. Summary: Teaching Critical Thinking Effectively

Barry Beyer introduced an analogy for teaching thinking skills in *Practical Strategies for the Teaching of Thinking*. Since successfully teaching someone to play tennis (or any physical activity) requires focus on the individual skills **and** focus on how to combine the skills to achieve the outcome of winning the game, teaching critical thinking might take a similar approach.

> Thinking skills, on the other hand, are very specific operations we deliberately perform on, or with, data to accomplish our thinking goals - operations like identifying a problem, finding unstated assumptions, or assessing the strength of an argument. In a way, thinking is like playing tennis or any other skilled performance. Combining many procedures, it is still greater in sum than all these procedures combined. Just as tennis consists of many specific skills - serving, making drop shots, lobbing, and volleying, thinking too consists of specific skills, the mastery of each of which contributes to effectiveness in the entire process. Just as playing tennis requires the integration of specific skills with an overall strategy in a given context for a purpose, so too does thinking require the integration of specific skills with an overall strategy in a given context for a purpose. Thinking, like tennis or any other skilled performance, is more than a bag of individual skills.[200]

The successful experiments described in Section 4.3.2. of this report illustrate what is needed for effective training in critical thinking (indeed, for any topic):

1. Have a clear desired outcome – what is the increased critical thinking expected to accomplish?
2. Have a shared, understandable, and comprehensive definition of critical thinking that will address the desired outcome and includes:
    a. Thinking skills
    b. Thinking dispositions
    c. Maturity of personal epistemology
    d. How critical thinking supports intelligence analysis

[199] Tecuci, G., Schum, D., Boicu, M., Marcu, D., Hamilton, B. & Wible, B. "Teaching Intelligence Analysis with TIACRITIS," *American Intelligence Journal*, Vol. 28, No. 2, 2010, pp. 50-51.
[200] R Beyer, B.K. *Practical Strategies for the Teaching of Thinking*, Allyn and Bacon, Boston, MA, 1987, p. 38.

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3. Have a well-designed program to develop the analyst's thinking skills, dispositions, and epistemology.
    a. Topics/contents (see Table 11 for the recommended skills and dispositions)
    b. Instructional methodologies
    c. Opportunities for meaningful practice
    d. Faculty well trained in all of the above
    e. Consistent implementation by all faculty involved
4. Secure or develop an assessment that will confirm students learned what was intended and achieved the desired outcome.
5. Take corrective action to ensure program is able to deliver what promised.

4.4 Assessing Critical Thinking

After training someone to think critically, it is important to be able to determine if the individual learned enough to be a critical thinker. The ability to assess someone's skills or dispositions has long been of interest to critical thinking scholars. The earliest known critical thinking assessment was available in 1938. Over 90 documents reviewed for this study addressed assessments in some fashion. The documents reviewed mentioned the following kinds of assessments:

Standardized, publicly available assessments:

- Critical thinking skills such as the Cornell Critical Thinking Test and the WGCTA
- Critical thinking dispositions such as the CCTDI
- General achievement or screening tests with critical thinking components such as Law School Admissions Test and the Collegiate Learning Assessment

Custom-developed assessments:

- Rubrics - formal descriptions of expected outcomes and performance standards typically defined for use in one organization or institution
- Ad hoc assessments such as those identified in the previous section for nursing education
- Performance-based assessments such as the evaluation implied in the Baker University study

James Breckenridge identified four levels of assessment that can be used to determine training effectiveness. The levels are:

- Level 1: Documents the participants' *reactions* to the training, usually with a familiar questionnaire asking ''How satisfied were you with . . .?''
- Level 2: Assesses students' *knowledge gained*, typically through pre- and post-course testing.
- Level 3: Evaluates the *transfer of knowledge* to the learner's work environment by assessing behavior on the job using reports from self, bosses, and peers.

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- Level 4: Assesses the training *results* or *outcomes* at the organizational level, for example, in quality, efficiency, or customer satisfaction statistics; revenues; or some other metric of strategic corporate goal.[201]

Levels 3 and 4 are the most pertinent to our discussion regarding intelligence analysis. That is, was the student able to apply what he or she learned at work? Did the new knowledge or skill have a measurable impact on the person's deliverables? For example, did students improve the quality of the intelligence they produced?

Because the documents reporting assessment results were primarily focused on college students, there was little opportunity to assess level 3 or 4 outcomes. The literature I found reported the use of a variety of Level 2 evaluation methods:

- Pre-test, post-test situations to identify the amount of growth that had been achieved through some intervention to develop thinking skills or dispositions.
- Post-test only to assess the skill or disposition level of cohorts of individuals.
- Post-test only for comparison among institutions.

As noted earlier in this report, the Baker University experiment implied a Level 3 assessment because the training was intended to improve performance in the senior capstone. However, Baker did not provide data on actual student performance on the senior capstone project after the University provided the critical thinking training.

4.4.1. Standardized Assessment Descriptions

We were unable to secure actual copies of the assessments listed below, but did obtain descriptions of the assessments from their authors:

- Watson Glaser Critical Thinking Appraisal
- CCTST
- Halpern Critical Thinking Assessment
- CCTDI

We secured copies of the following assessments:

- Cornell Critical Thinking Tests
- Ennis-Weir Critical Thinking Essay Test

In addition to these publicly available assessments, a number of scholars described assessments they used in their research such as Stanovich's Actively Open-Minded Thinking assessment. Since these assessments are not publicly available, they are not addressed in this report.

Watson-Glaser II Critical Thinking Appraisal: Goodwin Watson and Edward Maynard Glaser first published this assessment in 1938 and updated it periodically thereafter. Pearson, parent company of a variety of businesses including Pearson Education and Pearson TalentLens, now owns the assessment and has incorporated it into the Critical Thinking Boot Camp training program described previously in this report. From the introduction of the appraisal:

[201] Breckenridge, J.G. "Designing Effective Teaching and Learning Environments for a New Generation of Analysts," *International Journal of Intelligence and Counterintelligence*, Vol. 23, No. 2, 2010, p. 308.

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Watson and Glaser (Glaser, 1937; Watson & Glaser, 1994) believed that critical thinking includes:

- attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true,
- knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined, and
- skills in employing and applying the above attitudes and knowledge.[202]

Consistent with this conceptualization, the Watson-Glaser II has maintained the same approach to measuring critical thinking. Each Watson-Glaser II subtest is composed of reading passages or scenarios that include problems, statements, arguments, and interpretations of data similar to those encountered on a daily basis at work, in the classroom, and in newspaper or magazine articles. Each scenario is accompanied by a number of items to which the participant responds.[203]

CCTST: Peter Facione developed this assessment based on the APA consensus definition of critical thinking. The web page from the publisher of this assessment contains the following description:

> The **CCTST Family** is a set of critical thinking skills tests based on the Delphi Expert Consensus Definition of Critical Thinking. Research has shown that these instruments predict strength in critical thinking in authentic problem situations and success on professional licensure examinations. As measures of core critical thinking skills, these tools address the application of one's reasoning skills for the purpose of forming a reflective judgment about what to believe or what to do in a given context or problematic situation.
>
> All the tests listed below in the CCTST family provide objective measures of critical thinking skills. Different questions progressively invite test-takers to analyze or to interpret information presented in text, charts, or images; to draw accurate and warranted inferences; to evaluate inferences and explain why they represent strong reasoning or weak reasoning; or to explain why a given evaluation of an inference is strong or weak.[204]

Halpern Critical Thinking Assessment: Diane Halpern defined the Halpern Critical Thinking Assessment (HCTA) in order to achieve some balance between the ease of scoring a multiple choice assessment with the need for asking for open-ended responses. Halpern's web page contains a description of the assessment and links to sample questions.

> Unlike other tests of critical thinking, the HCTA uses both open ended and forced choice questions. Both response formats have advantages and limitations. Forced choice questions assess the ability to recognize a correct response, but there are few instances in real life where people are presented with an array of answers to select from. Recognition is a lower-level cognitive skill, which is expected to yield higher estimates of critical

[202] Watson, G. & Glaser, E.M. *Watson-Glaser II Critical Thinking Appraisal Technical Manual and User's Guide*, NCS Pearson, Inc., San Antonio, TX, 2009, p. 2.
[203] Watson & Glaser, p. 2.
[204] "California Critical Thinking Skills Tests," Insight Assessment. Available: http://www.insightassessment.com/, Viewed: 29 April 2010, p. 2.

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thinking skill than constructed response questions, which requires higher-level cognitive processing. The disadvantage of constructed response questions is that they benefit people with good writing skills, and thus may underestimate the critical thinking skills of mediocre writers. There is evidence that multiple-choice and open-ended responses are measuring separate cognitive abilities (Bridgeman & Moran, 1997). The constructed response portion of the HCTA attempts to reveal more of the dispositional component of thinking, as it allows test-takers to demonstrate whether they are inclined to apply the appropriate skills (Ku, 2009).[205]

CCTDI: Peter and Noreen Facione developed this assessment based on the APA consensus list of dispositions. This is the only assessment that deals specifically with dispositions rather than skills. The web page from the publisher of this assessment contains the following description:

> There are seven scales on the CCTDI. Each describes an aspect of the overall disposition toward using one's critical thinking to form judgments about what to believe or what to do. People may be positively, ambivalently, or negatively disposed on each of seven aspects of the overall disposition toward critical thinking. The CCTDI also provides a Total score which gives equal weight to each of the seven.
>
> - Truthseeking
> - Open-mindedness
> - Analyticity
> - Systematicity
> - Critical Thinking Self-Confidence
> - Inquisitiveness
> - Maturity of Judgment [206]

Cornell Critical Thinking Tests: Robert Ennis and Jason Millman developed this assessment. The introduction to the manual associated with the assessment explains the conceptual foundation for the tool:

> The working definition of "critical thinking" under which we are operating is this: "Critical thinking is reasonable and reflective thinking focused on deciding what to believe or do." This definition is an attempt to capture the main thrust of the term 'critical thinking' as it is used these days.
>
> There are many ways to dissect and subcategorize critical thinking ability. Our approach sees three types of inferences to beliefs (induction, deduction, and value judging); and four types of bases for such inferences, which are: 1) the results of other inferences, 2) observations, 3) statements made by others, and 4) assumptions. Furthermore, close attention to meaning must permeate one's dealing with the three types of inferences and four types of bases.[207]

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[205] Halpern, D.F. "Halpern Critical Thinking Assessment (HCTA)," Schufried Publishers. Available: http://www.cmc.edu/pages/faculty/dhalpern/index_files/Page1667.html, Viewed: February 7, 2012.

[206] "California Critical Thinking Disposition Inventory: Scale Descriptions," Insight Assessment. Available: http://www.insightassessment.com/Scales%20CCTDI.html, Viewed: October 9, 2009.

[207] Ennis, R.H., Millman, J. & Tomko, T.N. *Cornell Critical Thinking Tests Level X & Level Z Manual*, 5th ed., The Critical Thinking Co., Seaside, CA, 2005, pp. 1-2.

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There are two versions of the assessment: Level X for students in grades 4-14 and Level Z for advanced and gifted high school students, college and graduate students, and other adults.

Ennis-Weir Critical Thinking Essay Test: Robert Ennis and Eric Weir developed this essay-based assessment as an alternative to multiple choice assessments. The introduction explains the purpose of the tool:

> *The Ennis-Weir* is a general test of critical thinking ability in the context of argumentation. This type of context is one in which someone is trying to defend a point, and in which the defense is usually preceded and succeeded by other argumentation on the point or aspects of it. In this test, a complex argument is presented to the test taker, who is asked to formulate another complex argument in response to the first. The test is intended to help evaluate a person's ability to appraise an argument and to formulate in writing an argument in response, thus recognizing a creative dimension in critical thinking ability.[208]

Table 12 contains a summary of the primary focus of each assessment. Although I found a number of writers who provided opinions on the quality of one or more of these assessments, I found no reports comparing the outcomes or effectiveness of these assessments. I found no information proving the validity of one assessment over another.

[208] Ennis, R.H. & Weir, E. *The Ennis-Weir Critical Thinking Essay Test*, Midwest Publications, Pacific Grove CA, 1985, p. 1.

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Table 12: Comparison of Standardized Critical Thinking Assessments

Watson-Glaser Critical Thinking Appraisal:	**Cornell Critical Thinking Test**:	**The Ennis-Weir Critical Thinking Essay Test**:	**CCTST**:	**Halpern Critical Thinking Assessment**	**California Critical Thinking Dispositions Test**
• Inference • Recognition of Assumptions • Deduction • Interpretation • Evaluation of Arguments	Level X: • Inductive Inference • Credibility of Sources and Observation • Deduction • Assumption Identification Level Z: • Deduction • Meaning • Credibility • Inductive Inference • Definition and Unstated Reasons • Assumption Identification	• Getting the point • Seeing the reasons and assumptions • Stating one's point • Offering good reasons • Seeing other possibilities • Responding appropriately to and/or avoiding: + Equivocation + Irrelevance + Circularity + Reversal of an "if-then" (or other + conditional) relationship + The straw person fallacy + Overgeneralization + Excessive skepticism + Credibility problems + The use of emotive language to persuade	• Analysis • Interpretation • Inference • Evaluation • Explanation	• verbal reasoning (e.g., recognizing the use of pervasive or misleading language), • argument analysis (e.g., recognizing reasons and conclusions in arguments), • hypothesis testing (e.g., understanding sample size, generalizations), • using likelihood and uncertainty (e.g., applying relevant principles of probability, base rates), • decision making and problem solving (e.g., identifying the problem goal, generating and selecting solutions among alternatives).	• Truthseeking • Open-mindedness • Analyticity • Systematicity • Critical Thinking Self-Confidence • Inquisitiveness • Maturity of Judgment

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A number of organizations used customized assessments rather than the standardized assessments. These are introduced in the next section.

4.4.2. Customized Assessments

An organization develops a customized assessment when it has specific attributes or outcomes that it wants to evaluate. Customized assessments can be tailored for the specific needs of the organization and its unique competencies and outcomes. This report takes a closer look at two types of customized assessments:

- Rubrics
- Performance assessments

Rubrics: A *rubric* is an assessment tool that defines expected outcomes and performance standards. Once the rubric is defined, it can be used to guide instructional content, inform students of expected outcomes, and assess accomplishments.

William Pierce described the value of rubrics and provided several samples:

> Professors who teach thinking skills such as arguing, analyzing, synthesizing, drawing conclusions, solving problems, making decisions, and evaluating need to know how well their students can use these skills. Using rubrics that describe several different levels of student performance
>
> - helps professors evaluate consistently and efficiently
> - lets students know what their professor is looking for and how to meet the expectations
> - provides feedback to students.[209]

Figure 8 contains one of the samples provided by Pierce.[210]

[209] Peirce, W. "Designing Rubrics for Assessing Higher Order Thinking," Available: http://academic.pgcc.edu/~wpeirce/MCCCTR/Designingrubricsassessingthinking.html, Viewed: 7 February 2012.
[210] Peirce, W. "Designing Rubrics for Assessing Higher Order Thinking," Available: http://academic.pgcc.edu/~wpeirce/MCCCTR/Designingrubricsassessingthinking.html, Viewed: 7 February 2012.

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Rubric Component	4	3	2	1
Identifies and summarizes the problem/question at issue.	Accurately identifies the problem/question and provides a well-developed summary.	Accurately identifies the problem/question and provides a brief summary.	Identifies the problem/ question and provides a poor summary or identifies an inappropriate problem/question.	Does not identify or summarize the problem/question accurately if at all.
Identifies and assesses the quality of supporting data/evidence	Provides a well-developed examination of the evidence and questions its accuracy, relevance, and completeness. Clearly distinguishes between fact and opinion.	Examines evidence and questions the quality. Distinguishes between fact and opinion.	Merely repeats information provided. Does not justify position or distinguish between fact and opinion.	Does not identify or assess the quality of supporting evidence.

Figure 8: Mid-South Community College Critical Thinking Rubric

Diane Kelly-Riley et al. wrote about a critical thinking rubric used at Washington State University (WSU):

> We use the rubric as an instructional guide and as an evaluative tool using a 6-point scale for evaluation combining holistic scoring methodology with expert-rater methodology (Haswell. & Wyche, 1996; Haswell, 1998). Early studies conducted by CTLT and the Writing Programs indicated an atmosphere ready for implementation of a critical thinking rubric within the WSU curriculum.
>
> The instrument itself identifies seven key areas of critical thinking. The dimensions include

- problem identification
- the establishment of a clear perspective on the issue
- recognition of alternative perspectives
- context identification
- evidence identification and evaluation
- recognition of fundamental assumptions implicit or stated by the representation of an issue, and
- assessment of implications and potential conclusions.[211]

Figure 9 shows a sample portion of the Washington State rubric. [212]

[211] Kelly-Riley, D., Brown, G., Condon, B. & Law, R. *Washington State University Critical Thinking Project*, The Center for Teaching, Learning, Technology, General Education & The Writing Programs, Pullman, WA, 2001, pp. 2-3.
[212] Kelly-Riley et al., p. 9.

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1) Identifies and summarizes the **problem/question at issue** (and/or the source's position).

Scant	*Substantially Developed*
Does not identify and summarize the problem, is confused or identifies a different and inappropriate problem.	Identifies the main problem and subsidiary, embedded, or implicit aspects of the problem, and identifies them clearly, addressing their relationships to each other.
Does not identify or is confused by the issue, or represents the issue inaccurately.	Identifies not only the basics of the issue, but recognizes nuances of the issue.

2) Identifies and presents the STUDENT'S OWN **perspective and position** as it is important to the analysis of the issue.

Scant	*Substantially Developed*
Addresses a single source or view of the argument and fails to clarify the established or presented position relative to one's own. Fails to establish other critical distinctions.	Identifies, appropriately, one's own position on the issue, drawing support from experience, and information not available from *assigned* sources.

3) Identifies and considers OTHER salient **perspectives and positions** that are important to the analysis of the issue.

Scant	*Substantially Developed*
Deals only with a single perspective and fails to discuss other possible perspectives, especially those salient to the issue.	Addresses perspectives noted previously, and additional diverse perspectives drawn from outside information.

Figure 9: WSU Critical Thinking Rubric

Performance Assessments: Performance assessments provide evaluation at the Breckenridge's Level 3 or Level 4. This level of evaluation is summarized by two questions: can the individual transfer the knowledge to the work environment and does this transfer of knowledge actually improve performance?

Rubrics can be used in assessing performance. However, I found nothing in the literature that reported on performance assessments using rubrics.

I found only one study comparing critical thinking ability with actual performance in a project or in work as part of the assessment literature. The nursing literature reported on a study comparing critical thinking competence with clinical performance and found no correlation. The authors did report a correlation between years of nursing and competence.

> *Question 3:* Is there a relationship between critical thinking ability and level of competence as defined by Benner's stages of skill acquisition and measures on the 6-D Scale? Survey data included self-rating responses for stage of skill acquisition and measures on the 6-D Scale. Critical thinking measurement as a professional nurse was collected (WGCTA-3) and compared to perceived level of competence as measured by Benner's stages and the 6-D Scale. Multiple regression, analysis of variance and correlational techniques were used. Analysis was performed on the subsample of 30.

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> Findings revealed no significant effect, i.e., critical thinking ability had no influence on measures of nursing competence. The correlation matrix (N=24 complete cases).[213]

Baker University implied a performance objective when they specified that the outcome of their program was to improve competence on the senior capstone project. They did not, however, explicitly report on the results of their efforts to improve student performance on this project.

4.4.3. Assessments in the Intelligence Analysis Literature

Only two documents in the intelligence literature mentioned critical thinking assessments.

Fischl and Gilbert reported on one additional application of an assessment in 1983: its use in hiring. They tested whether the WGCTA would be useful in hiring intelligence analysts; they concluded that it would be beneficial. Although they theorized that the WGCTA might be useful in hiring, I found no follow up studies that evaluated whether individuals hired using the proposed assessments actually performed better as analysts.

> The three-test battery consisting of the Watson-Glaser Critical Thinking Appraisal, and the Memory and Expression subtests from the series of Flanagan Industrial Tests, requires about one hour for administration and is scorable by a clerk using stencil overlays.
>
> On the basis of the investigation performed, it appears that a relatively short battery of easily administered and scored tests can appreciably improve the procedure for selection of intelligence analysts.[214]

David Moore's book *Critical Thinking and Intelligence Analysis* mentioned the possibility of providing compensation for mastery of critical thinking skills, and noted that mastery would need to be assessed. The assessment he references is an assessment developed as part of the admissions process to Cambridge University.

> If an analyst adopts a congeries of skills that contributes to the mastery of critical thinking, and is compensated monetarily, that mastery needs to be certified. If a curriculum that drives the acquisition of those skills is in place, then an assessment of those skills can be administered in-house. Specific tests exist for the assessment of critical thinking, such as the "Thinking Skills Assessment Test."[215]

Moore also reported that the DIA tested some of its analysts using the WGCTA, but provided no information on the findings or results of the assessment.[216]

The lack of attention in the literature to critical thinking assessments may represent an omission within the intelligence community's body of knowledge.

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[213] Maynard, C.A. "Relationship of Critical Thinking Ability to Professional Nursing Competence," *Journal of Nursing Education*, Vol. 35, No. 1, 1996, p. 16.
[214] Fischl, M.A. & Gilbert, A.C.F. *Selection of Intelligence Analysts*, ADP000869, Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA, 1983, p. 389.
[215] Moore, D.T. *Critical Thinking and Intelligence Analysis*, Joint Military Intelligence College, Washington, D.C., 2006, p. 70.
[216] Moore, p. 65.

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4.4.4. Summary: Using Assessments Effectively

The variety of assessments and assessment approaches that exist provide multiple methods to determine the extent that an individual learned something from training and the extent that he or she is able to apply that learning to the job. However, before selecting or developing an assessment, the intelligence community must first determine what definition or description of critical thinking supports intelligence analysis, how critical thinking fits within intelligence analysis, what specific skills and dispositions are needed, and how these might be demonstrated. Once these elements are determined, an evaluation of standardized assessments can take place to determine their relevance and value. If the standardized assessments prove to be inadequate, the intelligence community can commission or develop customized assessments.

A definitive answer regarding the usefulness of an assessment in determining whether an individual has the right thinking abilities or dispositions in order to predict performance as an intelligence analyst does not yet exist.

Because performance assessments address actual on the job performance, they are far more important than the Level 1 or Level 2 assessments that are the primary topics in the literature and the focus of standardized assessments. If they were available, performance assessments of critical thinking in the intelligence community would provide insight into whether or not critical thinking can improve analysis. They might also help determine which teaching approaches are most effective.

The use of assessments that measure skill attainment at Levels 3 or 4 is a topic that would benefit from additional research in the intelligence community. Without some indication that critical thinking improves analyst performance and analytic results, little reason exists for investing in the development of critical thinking competency in intelligence analysts.

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4.5 Critical Thinking in the Intelligence Analysis Literature

So far in this report we have explored what critical thinking is, the enablers of critical thinking, how to train someone to think critically, and how to determine whether someone is able or willing to think critically. Although I have included intelligence analysis examples, the primary focus has been on these topics across all industries. This section of the report focuses exclusively on critical thinking in the intelligence analysis literature. Topics include:

- History of critical thinking in the intelligence literature
- Definitions of critical thinking for intelligence analysis
- How to apply critical thinking in intelligence analysis
- Potential next steps to improve understanding of how critical thinking might enhance the quality of intelligence analysis in the future

The reports on critical thinking have given little attention to additional ingredients for effective intelligence analysis such as having appropriate knowledge or having an appropriate methodology for conducting analysis as was defined in *Framework for Analytic Cognition*.[217] Critical thinking might be a necessary and important part of effective analysis, but it is not sufficient by itself to guarantee high quality analysis.

4.5.1. A Brief History

Although the concept of critical thinking is currently recognized as an important part of successful intelligence analysis, the term was not as widely used in the past as it is today. Despite the public interest in educating people to think critically that began in the 1980s and accelerated when critical thinking became a national educational goal in 1990, the IC displayed limited interest in the subject until the 21st Century. I found a total of 128 documents that had at least one mention of critical thinking with respect to intelligence analysis. Table 13 contains a summary of these documents by year.

[217] In press

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Table 13: Critical Thinking in Intelligence Analysis Literature by Year

Year	# of Documents
1983	1
1994	1
1995	1
1996	1
1997	1
1998	2
1999	1
2000	2
2001	2
2002	5
2003	8
2004	3
2005	12
2006	9
2007	8
2008	23
2009	10
2010	22
2011	5
Undated	11
Total	**128**

Some documents described activities or characteristics that would be perceived today as pertaining to critical thinking without mentioning the term itself. For example, David Schum clearly described critical thinking activities in his 1987 book, *Evidence and Inference for the Intelligence Analyst*[218] although the term *critical thinking* is not used anywhere in the document. Rather, Schum uses terms such as inference, reasoning, and logic to describe what is now called critical thinking. David Moore's 2002 thesis *Creating Intelligence: Evidence and Inference in the Analysis Process*[219] follows Schum's model of describing critical thinking without actually using the term. The book *Psychology of Intelligence Analysis* by Richards Heuer also included activities that could be considered critical thinking, yet Heuer's only mention of critical thinking is to state that it does not mix well with idea generation and imagination.[220]

The earliest mention I found of the term *critical thinking* in intelligence analysis appeared in a 1983 document describing the use of a critical thinking assessment in personnel selection.[221]

[218] Schum, D.A. *Evidence and Inference for the Intelligence Analyst. Volume 1*, University Press of America, Lanham, MD, 1987.
[219] Moore, D.T. *Creating Intelligence: Evidence and Inference in the Analysis Process,* MSSI Thesis, Joint Military Intelligence College, 2002.
[220] Heuer, R.J.J. *Psychology of Intelligence Analysis,* Center for the Study of Intelligence, Washington, D.C., 1999, p. 69.
[221] Fischl, M.A. & Gilbert, A.C.F. *Selection of Intelligence Analysts,* ADP000869, Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA, 1983.

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Even when critical thinking was mentioned, authors rarely included any explanation of what was meant by the term. For example, the 1995 CIA document *A Compendium of Analytic Tradecraft Notes* includes references to critical thinking, primarily focused on how critical thinking is simply a part of the process:

> When analysts address uncertainty – matters that require interpretations and estimates that go well beyond the hard evidence - their argumentation must clarify the premises, suppositions, and other elements of critical thinking that underlie the judgments.[222]

A 1996 Joint Military Intelligence College Occasional Paper noted the lack of critical thinking in analyst training:

> Further exacerbating the problems that come with segmentation is the perception that doctrine can become an undesirable mental straight-jacket. The potential value of doctrine in Joint Pub 2-0, Joint Doctrine for Intelligence Support to Operations, is weakened because it actually promotes intuition over reason, as no emphasis is placed on analytical skills. Technical training is based on doctrine, and the technical training for intelligence personnel therefore includes little in managerial, reasoning, and critical thinking skills.[223]

David Moore and Lisa Krizan explicitly identified critical thinking as an important contributor to intelligence analysis in 2001 in their description of potential core competencies (characteristics, knowledge, skills, and abilities) for intelligence analysts. [224] They identified *thinking* as one of the needed abilities, and *critical thinking* as a needed skill. In 2003, Moore and Krizan expanded their viewpoint in "Core Competencies for Intelligence Analysis at the National Security Agency,"[225] which included the same emphasis on thinking and critical thinking and the same definition provided above. They emphasized that their list of competencies, reproduced in Figure 10, was a proposal for consideration rather than an approved list. [226]

[222] Central Intelligence Agency. *A Compendium of Analytic Tradecraft Notes* 1995, p. 7.
[223] Brei, W.S. *Getting Intelligence Right: The Power of Logical Procedure*, Joint Military Intelligence College, Washington, D.C., 1996, p. 1.
[224] Moore, D.T. & Krizan, L. "Intelligence Analysis: Does NSA Have What it Takes?" *Cryptologic Quarterly*, Vol. 20, No. 1-2, 2001.
[225] Moore, D.T. & Krizan, L. "Core Competencies for Intelligence Analysis at the National Security Agency," in *Bringing Intelligence About: Practitioners Reflect on Best Practices*, ed. R.G. Swenson, Joint Military Intelligence College, Center for Strategic Intelligence Research, Washington, D.C., 2003, p. 96.

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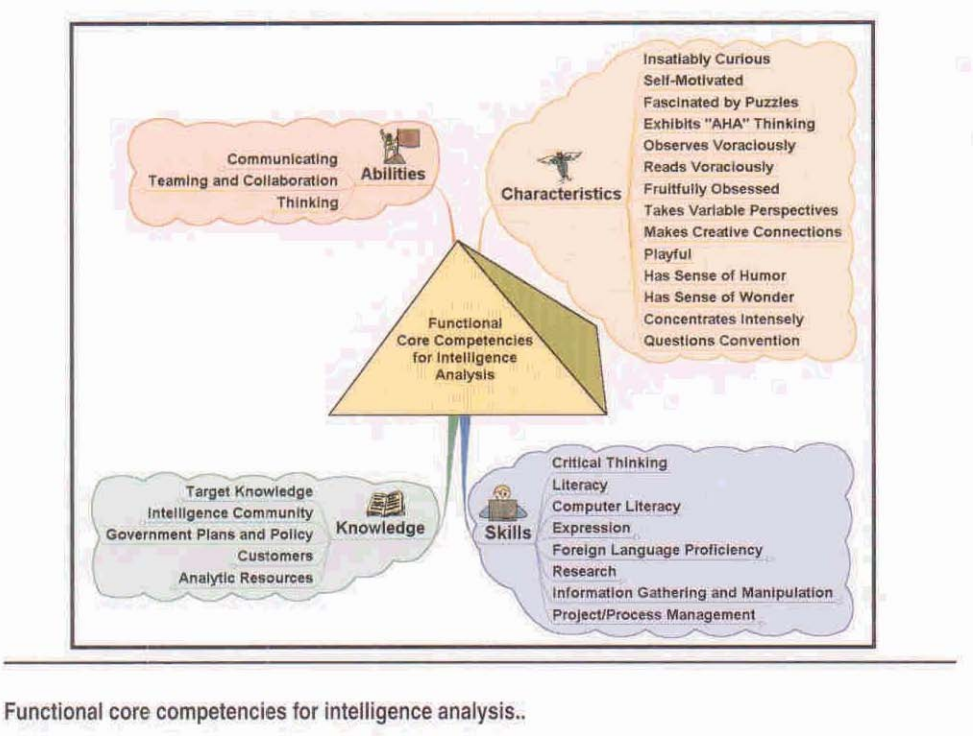

Figure 10: Moore and Krizan's Proposed Core Competencies for Intelligence Analysts

Stephane Lefebvre also highlighted the importance of critical thinking for intelligence analysis in 2004:

> Critical thinking is particularly important, as analysts use human source testimony to determine the intentions and plans of an adversary. The intelligence analyst must decide into which of mathematician Pierre Simon Laplace's four categories the testimonial evidence that was collected falls: ''(1) the witness does not deceive and is not mistaken, (2) the witness does not deceive and is in fact mistaken, (3) the witness does deceive and is not mistaken, and (4) the witness does deceive and is in fact mistaken.''[65] Testimony that is ''incomplete, inconclusive, and lacks credibility to some degree''[66] must be corroborated or graded (in terms of its force or weight). To be of any use, it must have credibility and probative force, and be relevant to the requirement at hand, bearing in mind that experience and intuition may have a role to play. [227]

David Moore wrote *Critical Thinking and Intelligence Analysis* in 2006, providing a thorough description of critical thinking and how it applies in intelligence analysis. The book includes the syllabus for a National Security Agency Critical Thinking and Structured Analysis course that he developed. Chapter titles include:

- What Is Critical Thinking?
  - Defining Critical Thinking
  - Standards for Critical Thinking
  - Skill-Based Definitions
  - A Disposition to Think Critically

[227] Lefebvre, S. "A Look at Intelligence Analysis," *International Journal of Intelligence and Counterintelligence,* Vol. 17, No. 2, 2004, p. 243.

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- The Role of Questions
- Pseudo-Critical Thinking

- What Can Be Learned from the Past?
- How Can Intelligence Analysts Employ Critical Thinking?
- How Can Analysts be Taught to Think Critically?
- How Does Critical Thinking Transform?[228]

As the term *critical thinking* became more commonplace, it was used in governing documents such as the 2006 *US Intelligence Community's Five Year Strategic Human Capital Plan*. The plan identified critical thinking as a needed general analytic competency. Note that although critical thinking is identified, no explanation is given to describe what is meant by the term.

> In partnership with the Deputy Director of National Intelligence for Analysis, we have completed the validation of an IC analytic competency model that identifies the set of critical knowledges, skills, and attributes required to conduct effective intelligence analysis, now and in the future. The model, to be completed and implemented in FY 2006, includes general analytic competencies (such as critical thinking); categories of "target" expertise, based on the topics and countries set forth in the NIPF; and analytic tradecraft — the tools and methods used by the intelligence disciplines, linked directly to IC quality standards for analytic products.[229]

The *Defense Intelligence Agency Strategic Plan 2007-2012* called for improving critical thinking as part of Goal 3: Produce the right intelligence for the right customer at the right time. This plan also introduced a new concept of *critical thinking models*, without explanation of what is meant by critical thinking models. Objective 3.3 states:

> **Objective 3.3**
>
> **Foster critical thinking and promote long-term strategic analysis and warning through the use of advanced research methods and techniques**.
>
> DIA will develop expertise in the use of advanced analytic methods and techniques that build on past knowledge. This includes the integration of critical thinking models and diverse perspectives in the development of analytic output. The Agency will provide customers with analytic judgments that clearly identify opportunities, vulnerabilities, and uncertainties. DIA will:
>
> - Create an environment for analysts to use critical thinking and basic structured analysis techniques to mitigate bias, understand mindsets, and incorporate competing views to help guide the national dialogue regarding threats to the United States and its interests.
> - Institutionalize forward-looking strategic analytic methods and techniques to increase long-term strategic analytic production to ensure warning of future threats.[230]

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[228] Moore, D.T. *Critical Thinking and Intelligence Analysis*, Joint Military Intelligence College, Washington, D.C., 2006, pp. iii-iv.
[229] Anonymous. *The US Intelligence Community's Strategic Human Capital Plan: An Annex to the US National Intelligence Strategy*, Office of the Director of National Intelligence, Washington, D.C., 2006, p. 12.
[230] Anonymous. *Strategic Plan 2007-2012. Leading the Defense Intelligence Enterprise*, Defense Intelligence Agency, Washington, D.C., [undated], pp. 13-14.

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As noted in the sections of this report on definitions and skills, *ICD Number 610*[231] explicitly identified critical thinking as a required competency for the IC.

By 2008, Noel Hendrickson can state in *Critical Thinking in Intelligence Analysis*, "Critical thinking appears on almost every list of the essential skills for intelligence analysts."[232]

However, the enthusiasm for critical thinking is not supported by any demonstration of its ability to improve the results of intelligence analysis. I found no studies assessing the benefit of critical thinking to intelligence analysis. Chin Tam completed a literature search of critical thinking and intelligence analysis in 2009 and noted the same lack:

> After the initial review in current literature, we found that few have investigated the link between critical thinking and intelligence analysis. While there has been work trying to link the two, there has not been any empirical evidence showing the correlation. Many authors speculate that the link does exist but no definitive correlation exists currently. In order for that to happen, two issues must be resolved: a) criteria matrix for scoring intelligence analysis and b) tools or methodologies to quantitatively measure that. At the present neither of these issues has been solved. Within the limited scope of this effort, it may be unrealistic to establish a definitive link between critical thinking skills and intelligence analysis.[233]

Within ten years of its proposal, critical thinking was identified as a required competency. However, this requirement was not based on a common understanding of critical thinking nor on an evaluation of how it actually benefits intelligence analysis. The next two sections illustrate this concern.

4.5.2. What is Critical Thinking in Intelligence Analysis?

Of the 106 documents we located that contained definitions of critical thinking, 21 documents came from the intelligence analysis literature. Seven of the intelligence documents referenced definitions from other disciplines, 13 of the documents provided new definitions, and some did both. Although common themes do exist in the intelligence analysis critical thinking definitions, some of the definitions have unique aspects, as the samples in Table 14 illustrate.

One challenge for critical thinking scholars working in academia is that they are attempting to provide a generic definition that might be applicable in many environments. A common definition of critical thinking tailored to intelligence analysis could exist since the environment is well-known to practitioners and scholars in the field.

Examples of the definitions I found while searching the intelligence literature are shown in Table 14. The examples were selected to illustrate the breadth of understanding of thinking critically in the intelligence literature. The *source* identifies whether the definition came from another discipline or was created by the author of the document. Some definitions were provided in earlier sections of this report and are included again for context.

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[231] Office of the Director of National Intelligence. *Intelligence Community Directive Number 610. Competency Directories for the Intelligence Community Workforce.* 2008.
[232] Hendrickson, N. "Critical Thinking in Intelligence Analysis," *International Journal of Intelligence and Counterintelligence*, Vol. 21, No. 4, 2008, p. 679.
[233] Tam, C.K. *Behavioral and Psychosocial Considerations in Intelligence Analysis: A Preliminary Review of Literature on Critical Thinking Skills*, AFRL-RH-AZ-TR-1009-0009, Air Force Research Laboratory, Mesa, AZ, 2009, p. 2.

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Table 14: Critical Thinking Definitions in the Intelligence Analysis Literature

Author and Source	Definition
Moore and Krizan *Source is the Foundation for Critical Thinking*	An intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action .... Thinking about [our] thinking while [we're] thinking in order to make [our] thinking better.[234]
Smith *Source is own definition*	Critical thinking involves analyzing a problem in depth, which in turn often requires extrapolation and the projection of observed patterns and trends into the long- or short-term future based on statistics and mathematical probability.[235]
Waltz *Source is own definition*	Critical thinking is based on the application of a systematic method to guide the collection of evidence, reason from evidence to argument, and apply objective decision-making judgment (Table 4.10). The systematic methodology assures completeness (breadth of consideration), objectivity (freedom from bias in sources, evidence, reasoning, or judgment), consistency (repeatability over a wide range of problems), and rationality (consistency with logic). In addition, critical thinking methodology requires the explicit articulation of the reasoning process to allow review and critique by others.[236]
Bruce and George *Source is own definition, with a connection to Foundation for Critical Thinking*	Critical thinking is that mode of thinking about any subject, content, or problem in which the individual improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it. Critical thinking is largely self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes rigorous standards of excellence and mindful command of their use.[237]
Analysis 101 Participant Guide *Source is own definition*	Critical thinking is quality control for problem solving and reasoning. Critical thinking enables you to judge the accuracy and relevance of your information, categorize information as assumption, fact, or inference, identify gaps in your knowledge, recognize factors that influence your objectivity and the objectivity of others, and judge the validity of your arguments.[238]
Hess and Friedel *Source is the APA consensus definition*	We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based.[239]
Intelligence Community Directive Number 610 *Source is own definition*	**Critical Thinking** - IC employees are expected to use logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to effectively inform decisions and outcomes. • Creative Thinking • Exploring Alternatives • Enterprise Perspective. • Situational Awareness • Synthesis [240]
Bennett *Source is own definition*	**Critical Thinking.** *Uses logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to inform decisions and outcomes.*[241]

[234] Moore, D.T. & Krizan, L. "Intelligence Analysis: Does NSA Have What it Takes?" *Cryptologic Quarterly, Vol. 20*, No. 1-2, 2001, p. 14.
[235] Smith, T.J. "Predictive Warning: Teams, Networks, and Scientific Method," in *Analyzing Intelligence: Origins, Obstacles, and Innovations*, eds. R.Z. George & J.B. Bruce, Georgetown University Press, Washington, D.C., 2008, p. 270.
[236] Waltz, E. *Knowledge Management in the Intelligence Enterprise*, Artech House, Boston, MA, 2003, pp. 143-144.
[237] Bruce, J.B. & George, R.Z. "Introduction: Intelligence Analysis - the Emergence of a Discipline," in *Analyzing Intelligence: Origins, Obstacles, and Innovations*, eds. R.Z. George & J.B. Bruce, Georgetown University Press, Washington, D. C., 2008, p. 311.
[238] Anonymous. *Analysis 101. Participant Guide* 2008, p.11.
[239] Hess, J. & Friedel, C. "Applying Critical Thinking to Intelligence Analysis," *American Intelligence Journal, Vol. 26*, No. 1, 2008, p. 31.
[240] Office of the Director of National Intelligence. *Intelligence Community Directive Number 610. Competency Directories for the Intelligence Community Workforce* , p. B-2.

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Although the different characteristics found in these definitions all appear valuable, the multiple definitions do not help us understand unambiguously what is meant when the term *critical thinking* is used in an intelligence analysis context. The existence of these diverse definitions raises important questions:

- Which definition of critical thinking, if any, will improve analysis?
- Does critical thinking include creativity and an enterprise perspective as identified in *ICD Number 610*?
- Does it include extrapolation and projection as identified by Smith?
- Is it focused on analyzing and assessing your own thinking as Bruce and George described it?

Sherman Kent noted the problem of ambiguous terminology in his 1955 essay "The Need for An Intelligence Literature:"

> If we do not rigorously define our terms we are likely to find ourselves talking at cross purposes; and such discussion, we all realize, risks being more of a fruitless dispute than an elevated debate.[242]

It is clear that the IC has not yet reached the point of having an elevated debate about critical thinking. The confusion continued when authors attempted to describe how to apply critical thinking to analysis work as illustrated in the next section.

4.5.3. Applying Critical Thinking to Intelligence Analysis

I found very different perspectives for what constitutes thinking critically when performing intelligence analysis. The existence of these differing perspectives has a major impact on how critical thinking would be taught to analysts and on the benefit that might be realized from thinking critically. The primary perspectives are:

- **Critical thinking is a quality of thinking** that one applies to every part of the analysis work, as concluded in this report (see Figure 2).
- Critical thinking is the same as or enabled by structured analysis; this approach **equates critical thinking with structured analysis or structured tools**. Promoters of this perspective believe that if one uses structured analytic tools, one automatically is thinking critically.
- Generally **confusing explanations of critical thinking**.

The same document sometimes contained different perspectives. In some cases the difference existed because the author of the foreword or introduction had a different perspective than the author of the text. In one document, however, the text itself had conflicting perspectives.

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[241] Bennett, B. "DIA's Analytic Competency-Based Training," *American Intelligence Journal*, Vol. 26, No. 2, 2008/2009, p. 27.
[242] Kent, S. "The Need for an Intelligence Literature," *Studies in Intelligence*, 45th Anniversary Special Edition, Fall, 2000, p. 6.

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Examples of Critical Thinking as a Quality of Thinking: David Moore's *Critical Thinking and Intelligence Analysis* described critical thinking as a way to perform analysis, that is, a qualitative approach to analysis.

> Critical thinking provides that framework by ensuring that each form of reasoning is appropriately used. Critical thinking extends to the entire intelligence analysis process. The claim here is that analysts who become better critical thinkers will improve their analyses, helping to lessen the likelihood of intelligence failures.[243]

Analysis 101, which has also been called *Critical Thinking and Structured Analysis*, described critical thinking as a qualitative approach to conducting analysis:

> In this lesson, we lay the critical thinking and problem solving foundations, by offering common definitions, establishing a common language and showing how critical thinking can be constantly and effectively applied to the art of intelligence analysis.[244]

Examples That Equate Critical Thinking with Structured Analysis and Tools: Promoters of this perspective believe that if one uses structured analytic tools, one automatically is thinking critically. The challenge with this perspective is that structured analysis consists of tools or techniques, each of which can be applied at different points in the analysis work to improve the quality of analysis. Although critical thinking shares the intended outcome of improved analytic quality, an analyst can use structured analysis tools without necessarily engaging the *critical* quality of their thinking. However, many in the IC believe that critical thinking is the same as structured analysis. For example, Michael W. Collier provided this description.

> Thanks to the promotion of ACH by Heuer and his colleagues, critical thinking tools and techniques are becoming more widely employed in testing competing hypotheses using qualitative data.[30] Critical thinking skills that support divergent thinking include tools such as matrix analyses, decision trees, devil's advocate analysis, weighted ranking analyses, and utility theory. Such critical thinking skills should be mandatory tools in the kit of every intelligence analyst - without these tools the validity of qualitative analyses can quickly be called into question.[245]

Even with Moore's clear description of how critical thinking supports analysis in *Critical Thinking and Intelligence Analysis*, one of the introductions to the book stated that critical thinking is a structured analytic method. Jeffrey Cooper wrote:

> I urge the leadership of the IC to place far more emphasis on structured analytic methods. In my view, the transformation of the intelligence enterprise demands a more curious, more agile, and more deeply thoughtful cadre of intelligence analysts - but it should also require the same traits among its intelligence organizations and the intelligence enterprise as a whole. Moore notes that "Investment in critical thinking as part of the analysis process minimizes the likelihood of specific failures" (page 81). However, from my perspective, critical thinking (and other structured methods) are more important for

[243] Moore, D.T. *Critical Thinking and Intelligence Analysis*, Joint Military Intelligence College, Washington, D.C., 2006, p. 6.
[244] Anonymous. *Analysis 101. Participant Guide* 2008, p. 4.
[245] Collier, M.W. "A Pragmatic Approach to Developing Intelligence Analysis," *Defense Intelligence Journal, Vol. 14*, No. 2, 2005, p. 26.

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changing the organization's overall approach to analysis, rather than in improving specific judgments or preventing particular failures.[246]

Jack Davis wrote the introduction to Heuer's *Psychology of Intelligence Analysis*. He believed that Heuer's tools and techniques supported critical thinking. It should be noted that Heuer did not use the term *critical thinking* in the book except to state that it is not compatible with creative thinking. Although the concept of Structured Analytic Techniques was not widely adopted at the time of this book, the belief that using structured tools will lead to critical thinking is clear in this quote.

> **Heuer's Central Ideas**
>
> Dick Heuer's writings make three fundamental points about the cognitive challenges intelligence analysts face:
>
> - The mind is poorly "wired" to deal effectively with both inherent uncertainty (the natural fog surrounding complex, indeterminate intelligence issues) and induced uncertainty (the man-made fog fabricated by denial and deception operations).
> - Even increased awareness of cognitive and other "unmotivated" biases, such as the tendency to see information confirming an already-held judgment more vividly than one sees "disconfirming" information, does little by itself to help analysts deal effectively with uncertainty.
> - Tools and techniques that gear the analyst's mind to apply higher levels of critical thinking can substantially improve analysis on complex issues on which information is incomplete, ambiguous, and often deliberately distorted. Key examples of such intellectual devices include techniques for structuring information, challenging assumptions, and exploring alternative interpretations.[247]

Examples of Confusing Explanations of Critical Thinking: Richards Heuer described critical thinking as an activity rather than as a quality of thinking in *Taxonomy of Structured Analytic Techniques*. Interestingly enough, he also explicitly excluded it from structured analysis. Heuer identified four general categories of analysis methods: quantitative methods using empirical data; quantitative methods using expert-generated data; unaided judgment; and structured analysis.[248] He described critical thinking as useful only in unaided judgment:

- *Unaided Judgment:*[2] This is how most strategic and political analysis is now being done. It includes evidentiary reasoning, the basics of critical thinking, historical method, case study method, and reasoning by analogy.[3] *One very distinctive characteristic of unaided judgment is that it is usually an individual effort in which the thinking remains largely in the mind of the individual analyst until it is written down in a draft report.* Training in this type of analysis is generally provided through graduate education, especially in the social sciences and liberal arts.
- *Structured Analysis:* This uses structured techniques to mitigate the adverse impact on our analysis of known cognitive limitations and pitfalls. The most distinctive

[246] Moore, p. xiv.
[247] Heuer, R.J.J. *Psychology of Intelligence Analysis*, Center for the Study of Intelligence, Washington, D.C., 1999, p. 10.
[248] Heuer, R.J. "Taxonomy of Structured Analytic Techniques," *International Studies Association 2008 Annual Convention*, San Francisco, CA, March 26 - 29, 2008, pp. 2-3.

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> characteristic is that structured techniques *externalize* and decompose our thinking in a manner that enables it to be reviewed and critiqued piece by piece, or step by step, by other knowledgeable analysts. These techniques can be used by the average analyst who lacks advanced training in statistics, math, or the hard sciences. For most analysts, training in structured analytic techniques is obtained only within the Intelligence Community.[249]

Structured Analytic Techniques for Intelligence Analysis by Richards Heuer and Randolph Pherson continued the confusion about the relationship between critical thinking and structured analysis. As with *Taxonomy of Structured Analytic Techniques* referenced above, Heuer and Pherson identified critical thinking as useful in the expert judgment methodology (earlier called unaided judgment) rather than as part of the structured analysis methodology. The text in both books is similar. However, in the final chapter of *Structured Analytic Techniques for Intelligence Analysis*, Heuer and Pherson stated that critical thinking is a structured technique.

> The process for coordinating a National Intelligence Estimate (NIE) has changed dramatically. Formal coordination prior to publication of an NIE is now usually a formality, as there has been collaboration among interested parties from the inception, and all relevant intelligence is shared. The Key Assumptions Check and other basic critical thinking and structured analytic techniques have identified and explored differences of opinion early in the preparation of an estimate, and new analysis techniques, such as Premortem Analysis, Structured Self-Critique, and Adversarial Collaboration - all now described and discussed in the DNI knowledge management system - are being employed to define and resolve disagreements as much as possible prior to the final coordination.[250]

Wayne Michael Hall and Gary Citrenbaum identified critical thinking as one of 14 elements of advanced analysis in their book, *Intelligence Analysis: How to Think in Complex Environments*.

It is not at all clear from the text what the authors understand critical thinking to be. Hall and Citrenbaum used the following definition for critical thinking, which they note came from David G. Myers in *Exploring Psychology*:

> An intellectual process that "examines assumptions, discerns hidden values, evaluates evidence, and assesses conclusions."[251]

Their explanation of critical thinking is less helpful. The chapter on critical thinking addresses examining assumptions from the definition, but then reviews several other topics including the role of “deep think” in critical thinking, thinking errors, collection errors, and thinking like the enemy. The chapter ends with this summary:

> Critical thinking is important for bringing forth the best in thinking, because it asks the analyst to think in three spheres:
>
> *First*, the analyst must internalize critical thinking and consider how he or she is thinking as an individual.

---

[249] Heuer, pp. 2-3.
[250] Heuer, R.J. & Pherson, R.H. *Structured Analytic Techniques for Intelligence Analysis*, CQ Press, Washington, D.C., 2011, p. 342.
[251] Hall, W.M. & Citrenbaum, G.M. *Intelligence Analysis: How to Think in Complex Environments*, Praeger Security International, Santa Barbara, CA, 2010, p. 31.

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Second, the analyst must seek help from outsiders to help with thinking, as is the case with indigenous people and technical experts, and to examine his or her thoughts critically.

Third, the analyst must be critical of the way other people are thinking and learn to spot errors. They are obliged to challenge what appears to be erroneous assumptions and poor thinking.[252]

These conflicting perspectives about how critical thinking supports analysis illustrate the need for the intelligence community to reach a common understanding of all aspects of critical thinking within analysis. We must agree whether critical thinking is a quality of thinking used in all aspects of intelligence analysis, a structured tool similar to ACH, or a simple activity that is used occasionally.

This is an area needing additional attention in order to gain the maximum benefit from investments in developing critical thinking competencies.

4.5.4. Summary: Critical Thinking in the IC Literature

Critical thinking could be a useful descriptor for the cognitive aspects of analysis if a shared understanding existed of what is meant by the term. However, the literature actually contains competing descriptions of what critical thinking is and how it should be applied to benefit intelligence analysis.

The IC has not explored the enablers of critical thinking: thinking skills, thinking dispositions, and personal epistemology. Although only seven documents discussed thinking skills, those documents presented different perspectives of the necessary skills. Only one document addressed dispositions needed to think critically, and no documents addressed personal epistemology as a foundation for effective thinking.

We need to have the elevated debate called for by Sherman Kent to eliminate the ambiguity and confusion surrounding the term *critical thinking.* The IC needs:

- A shared understanding of what critical thinking is
- Agreement about the skills, dispositions, and personal epistemology needed to support intelligence analysis
- Agreement about how critical thinking should be applied to the analysis process

[252] Hall & Cetrenbaum, p. 120.

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5.0 CONCLUSIONS

5.1 Findings

The answers to the basic questions guiding this research are:

1. *What is critical thinking?* We do not have a clear answer.
   a. Although critical thinking is generally recognized as important (and scholars in all disciplines in this study make this case emphatically), a formal agreement on what critical thinking is does not exist either within the intelligence community or within other disciplines. However, common themes do exist that clarify critical thinking and identify its potential usefulness in intelligence analysis.
   b. Critical thinking is a concept describing a quality of thinking. It refers to *how* one approaches the thinking task. Critical thinking is useful when exploring a situation, phenomenon, question, or problem to arrive at a hypothesis or conclusion about it that integrates all available information and that therefore can be convincingly justified.
   c. Skills and dispositions such as those listed in Table 15 are *hows* that might be especially useful in contributing to the quality of thinking called critical thinking. As a quality of thought, critical thinking can and potentially should be applied to every part of intelligence analysis.

Table 15: Recommended Critical Thinking Skills and Dispositions for Intelligence Analysts

Critical Thinking Skills	Critical Thinking Dispositions
Interpretation	Willingness to engage in intellectual effort
Analysis	Systematic
Evaluation	Persistent
Inference	Intellectual integrity
Synthesis	Open-minded
Explanation	Intellectual curiosity
Self-regulation	

2. *What is the state of knowledge of critical thinking?* The best description of the current state of knowledge was provided by Condon and Riley: "The current literature on critical thinking is rife with conflict and competing ideologies."[253]
   a. Examples supporting this statement include the many different definitions, lists of skills and kinds of skills, and models of critical thinking that I found in the literature.
   b. Little attention has been devoted to critical thinking performance – are individuals with strong critical thinking skills and dispositions as measured by assessments able to perform better in work that appears to require critical thinking? This shortcoming is as apparent in the intelligence literature as it is in the literature from other disciplines.

[253] Condon, W. & Kelly-Riley, D. "Assessing and Teaching What We Value: The Relationship between College-Level Writing and Critical Thinking Abilities," *Assessing Writing*, Vol. 9, No. 1, 2004, p. 64.

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3. *Can we train someone to think critically?* Perhaps.
    a. Much of the education and training available to date in university courses, publicly available courses, and courses intended specifically for the intelligence community are based on simplistic descriptions of critical thinking, provide insufficient time for effective practice, use ineffective teaching strategies, and include few or ineffective methods of assessing what has been learned.
    b. Training that has been effective as demonstrated by performance on some sort of assessment was developed to teach a specific set of skills, dispositions, and operations in order to achieve a specific outcome. Successful training has been focused, well-designed, and consistently delivered, with extensive opportunities for practice.
4. *Can we assess someone's ability to think critically?* Again, perhaps.
    a. A number of standardized assessments and examples of customized assessments exist that address different aspects of critical thinking. It is not clear whether any of the currently available standardized assessments are beneficial for the IC. Few documents were found that described assessments designed for adults to be used in determining job readiness, suitability, or performance.[254] No documents were found describing how to assess whether someone uses critical thinking regularly in his or her job or life.
    b. Each publicly available assessment is somewhat different, focused on the critical thinking definition espoused by the assessment author.
    c. Publicly available assessments have primarily been used in assessing the impact that a class or an experience such as years in college has on the ability to think critically. That is, they assess an experience's impact at Level 2 in Breckenridge's schema.[255]
    d. Several documents provided guidelines for developing a custom assessment (i.e. rubrics) that could be designed for a unique environment such as the intelligence community. Those publications also provided examples of custom assessment tools.
5. *How can this understanding of critical thinking be applied to improving intelligence analysis?* The intelligence community needs to exert additional effort in order to benefit from investments in critical thinking.
    a. Critical thinking is widely recognized as an important competency for intelligence analysts. However, the IC does not yet have a common understanding of what critical thinking is or how to apply it in intelligence analysis work. Without a common understanding of critical thinking, the claims regarding its ability to improve intelligence analysis, the investments in training for it, and documents such as strategic plans calling for critical thinking are built on a weak foundation. Which version of critical thinking is

[254] One exception is a study of using the Watson Glaser Critical Thinking Assessment in hiring intelligence analysts completed in 1983.
[255] Breckenridge, J.G. "Designing Effective Teaching and Learning Environments for a New Generation of Analysts," *International Journal of Intelligence and Counterintelligence*, Vol. 23, No. 2, 2010, p. 308.

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expected to improve analysis? What critical thinking competencies will result in better analysis? How would critical thinking be recognized if it were present?

b. Current training in the IC varies widely. Courses exist with different definitions of critical thinking, a variety of topics covered, and varying amounts of practice available, resulting in analysts who have differing levels of critical thinking knowledge and abilities. Many courses are primarily designed to introduce analysts to the *concept* of critical thinking. These courses do not provide sufficient depth or time for practice that would enable an analyst to become a skilled critical thinker. I found no reports of training evaluations that demonstrated that the courses actually improved analyst competencies or performance.

c. Although it is widely believed that critical thinking will improve intelligence analysis, I found no reports demonstrating the benefit of critical thinking to intelligence analysis.

5.2 Opportunities for the Future

These findings provide a roadmap for research and activities that will demonstrate the utility of critical thinking to the IC. These activities will also identify the best way to integrate critical thinking into intelligence analysis to gain maximum benefit throughout the entire IC.

1. Define a concept of critical thinking that makes sense for intelligence analysis and that can be accepted throughout the IC. This definition should:
   a. Identify expected standards of critical thinking in intelligence analysis such as was presented with the sample rubrics discussed in the assessment section of this report.
   b. Identify the appropriate skills, dispositions, and personal epistemology maturity level needed for effective intelligence analysis.
   c. Clearly articulate how to apply critical thinking in intelligence analysis.
2. Evaluate the various aspects of critical thinking prior to making major investments in fostering it throughout the IC. Research projects might include:
   a. Investigating the impact that improved critical thinking skills and dispositions have on intelligence analysis.
   b. Determining an approach to training (including topics, teaching strategies, and practice mechanisms) that will provide the most improvement to the practitioners of intelligence analysis.
   c. Evaluating publicly available assessments and their usefulness for assessing an analyst's skills or dispositions and therefore predicting job performance or identifying training needs.
   d. Evaluating whether assessments of critical thinking skills, dispositions, and personal epistemology are useful in the hiring process.
3. Develop a consistent critical thinking training curriculum that includes topics that have been demonstrated to improve intelligence analysis and that uses best practices in skills training. Rigorously evaluate the effectiveness of the training and make appropriate improvements until the training meets the needs of the IC.

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a. The successful experiments described in section 4.3.2. of this report provide models of effective instruction.

b. The training used in nursing education provides a cautionary tale of training approaches to avoid.

4. Determine the best way to assess the thinking skills and dispositions of analysts and their ability to apply critical thinking to the analysis process. Develop an assessment methodology that measures not only the results of training, but the impact of that training on analytic results.

   a. For example, the sample rubrics included in the assessment section of this report provide information that is not only useful for assessment, but also useful in identifying performance expectations in advance. An analyst could use a rubric to guide his or her work efforts and evaluate his or her own analytic products.

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APPENDIX A - Critical Thinking Definitions

Appendix A contains all definitions found during the search conducted for this research effort. **Source** indicates the original source of the definition such as the Foundation for Critical Thinking or the APA study convened by Facione.

Definition	Author/Field	Date	Source
1. Thinking that helps students understand the logical connectives of English (Adler)	Lippman Education	2003	Adler
2. Peter Facione convened a group of individuals considered experts in the field of critical thinking to, among other tasks, develop a consensus definition of critical thinking: EXPERT CONSENSUS STATEMENT REGARDING CRITICAL THINKING AND THE IDEAL CRITICAL THINKER "We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, openminded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society."	Facione Philosophy	1990	APA
3. We understand critical thinking to be purposeful, self-regulatory Judgment which results in Interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based... CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life... While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon.	Facione et al. Philosophy	1994	APA

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Definition	Author/Field	Date	Source
4. An outcome from Facione's study was a classification of important skills and sub-skills which included interpretation, analysis, evaluation, inference, explanation, and self-regulation. This classification system was the basis of the Delphi study that we conducted with faculty, employers, and policymakers.	Jones et al. Education	1995	APA
5. critical thinking is "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based."	Spicer & Hanks Communications	1995	APA
6. The Delphi experts defined critical thinking as "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based."	Reed Education	1998	APA
7. We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based.	Facione Philosophy	2000	APA
8. We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life.	Montgomery Medical	2003	APA
9. Facione asserts that critical thinking is "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based."	Kelly-Riley et al. Education	2004	APA
10. We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry.	Hess & Friedel IA	2008	APA

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Definition	Author/Field	Date	Source
11. We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. (2009 update to the 1990 report found in 3634)	Facione Philosophy	2009	APA
12. Becoming conscious of one's own thinking so as to be able to transfer it from familiar to unfamiliar contexts (Arons)	Lippman Education	2003	Arons
13. In my analysis, epistemological understanding is not simply a sub-component. Rather it is the central concept through which critical thinking is conceptualized. It is that which underpins, justifies, and makes sense of the activities and dispositions related to reason-assessment.	Bailin Education	1997	Bailin
14. Critical thinking is the assessing of the authenticity, accuracy and/or worth of knowledge claims and arguments. (Beyer's own definition)	Beyer Education	1985	Beyer
15. Critical thinking is unique because it involves careful precise persistent and objective *analysis* of any knowledge claim or belief to *judge* its validity and/or worth.	Beyer Education	1985	Beyer
16. SC task force developed a definition that they adapted from several folks: Critical thinking is a reflective, systematic, rational, and skeptical use of cognitive representations, processes, and strategies about beliefs, problems, and/or courses of action.	Cook et al. Education	1996	Beyer, Ennis, Facione, McPeck, Sternberg
17. 'Critical thinking involves calling into question the assumptions underlying our customary, habitual ways of thinking and acting and then being ready to think and act differently on the basis of this critical questioning.' (Brookfield)	Hare Education	1999	Brookfield
18. The shorthand for critical thinking that has become most popular, probably because of an exercise we do, is "thinking outside of the box."	Eichhorn Army	2010	Creative thinking
19. Critical thinking consists essentially of "evaluating statements, arguments and experiences." (D'Angelo, 1971)	Beyer Education	1985	D'Angelo
20. In its most aggressive form "the spotting of faults." (DeBono, 1983)	Beyer Education	1985	DeBono
21. Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends constitutes reflective thought. Any one of the first three kinds of thought may elicit this type; but once begun, it includes a conscious and voluntary effort to establish belief upon a firm basis of evidence and rationality.	Dewey Education, philosophy, psychology	1910, 1934	Dewey

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22. Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends. (Glaser, 1941) Although Beyer credits Glaser, the original source is Dewey	Beyer Education	1985	Dewey
23. Reflective thinking: Reflection is the process of critically assessing the content, process, or premise(s) of our efforts to interpret and give meaning to an experience. (p. 104) Also notes that "Much of the current confusion in academic circles about the nature of critical thinking is the result of failing to differentiate among the three functions of reflection and to distinguish between reflective and nonreflective action." (p. 106)	Mezirow Education	1991	Dewey
24. Active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and the further conclusions to which it tends.	Fisher Philosophy	2001	Dewey
25. A model more generally applied across disciplines, critical thinking, developed out of the Socratic tradition of disciplined inquiry. Usually defined as a reasoned or questioning approach in which one examines assumptions and seeks evidence (Donald, 1985), researchers suggest that critical thinking includes components of logic, problem solving, and Piagetian formal operations (Meyers, 1986; Sternberg, 1985).	Hativa & Marincovich, Education	1995	Donald
26. Critical thinking is reasonable reflective thinking that is focused on deciding what to believe or do.	Ennis Education	1987	Ennis
27. Critical thinking is reasonable reflective thinking that is focused on deciding what to believe or do.	Ennis Education	1989	Ennis
28. The conception of critical thinking that is spelled out in this analysis is one we share. It involves the active and appropriate use of key critical-thinking skills in judging the reasonableness of ideas and the justification of actions, set in the context of attitudes and dispositions that place value on careful and open thinking. In critical thinking, so construed, we search for good reasons that aid us in making decisions.	Norris & Ennis Education	1989	Ennis
29. We feel that the following basic definition comes closer to expressing the way the term is generally used in education: *Critical thinking is reasonable and reflective thinking that is focused upon deciding what to believe or do.*	Norris & Ennis Education	1989	Ennis
30. Another way to describe it is reasonable, reflective, responsible, and skillful thinking that is focused on deciding what to believe or do.	Schafersman Education	1991	Ennis
31. Thus broadly conceived, CT was characterized as purposeful, self-regulatory judgment, a human cognitive process. As a result of this non-linear, recursive process a person forms a judgment about what to believe or what to do In a given context	Facione et al. Education	1994	Ennis

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Definition	Author/Field	Date	Source
32. More recently, Ennis (1987, p. 10) defined critical thinking as "reasonable, reflective thinking that is focused on deciding what to believe or do."	King & Kitchener Educational psychology	1994	Ennis
33. This is a doc by Jones for office of educational research. Cited multiple definitions. Robert Ennis (1987) defines critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do"	Jones et al. Education	1995	Ennis
34. reasonable reflective thinking that is focused on deciding what to believe or do	Bailin Education	1997	Ennis
35. The definition of critical thinking currently cited by those concerned with critical reading is the one advanced by Ennis: “reasonable, reflective thinking that is focused on deciding what to believe and do” (Norris & Ennis, 1989, p. 1). The transformation of critical reading and thinking is revealed by comparing this definition to the earlier definition advanced by Ennis in 1962: “the correct assessing of statements” (p. 81). The newer definition attends to the reflective nature of critical thinking, holding that thinkers must consciously seek and use good reasons, and it places deciding what to believe and do as the goal of critical thinking.	Douglas Education	2000	Ennis
36. R: The general consensus is that CT per se is judging in a reflective way what to do or what to believe. The cognitive skills of analysis, interpretation, inference, explanation, evaluation, and of monitoring and correcting one’s own reasoning are at the heart of critical thinking.	Facione Philosophy	2000	Ennis
37. CT is judgment, reflective and purposive.	Facione Philosophy	2000	Ennis
38. Thus conceived, CT was characterized as a self-adjusting process of judging what to believe or what to do in a given context. (pp. 7-8)	Facione Philosophy	2000	Ennis
39. Reasonable, reflective thinking about what to do and believe	Hatcher Education/philosophy	2000	Ennis
40. From Ennis: reflective thinking focused on deciding what to believe or do	Jonassen Education	2000	Ennis
41. Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do. (Cf. Norris and Ennis, 1989)	Fisher Philosophy	2001	Ennis
42. Reasonable reflective thinking that is focused on deciding what to believe or do (Ennis)	Lippman Education	2003	Ennis
43. Critical thinking is reasonable reflective thinking focused on what to believe or do" (Ennis, 1993).	Montgomery Medical	2003	Ennis

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Definition	Author/Field	Date	Source
44. new CT definitions specifically for nursing: Kataoka-Yahiro and Saylor (1994) defined critical thinking as reflective and reasoned thinking about nursing problems with more than one solution, focusing on decisions about what to believe and do.	Staib Nursing	2003	Ennis
45. The Ennis definition: Critical thinking is reasonable and reflective thinking focused on deciding what to believe or do.	Ennis Education	2005	Ennis
46. The following definition seems to be more in accord with contemporary usage and thus. I hope, will minimize confusion in communication: "Critical thinking is reasonable reflective thinking focused on deciding what to believe or do.'"	Ennis Education	1993	Ennis
47. In our view, thinking critically involves the ongoing judgment of one's own thinking, a view which is consistent with the spirit of Ennis' current definition: "Critical thinking is reasonable reflective thinking that is focused on deciding what to believe and do"	Tierney et al. Education	1989	Ennis
48. For this paper critical thinking is *the propensity and skills to engage in an activity with reflective skepticism focused on deciding what to reasonably believe or do.* Three broad criteria can be extracted from this definition: thinking must be reasonable, reflective, and focused to be considered critical thinking. Critical thinkers must not only possess the set of skills we have labeled the “reason assessment” component (elementary clarification, basic support, inference, advanced clarification, and strategies), but, also have the “critical spirit” component.	McKown Military	1997	Ennis and McPeck
49. Critical thinking involves thinking through problematic situations about what to believe or how to act where the thinker makes reasoned judgments that embody the attributes of quality thinking. Uncritical thinking: thinking that accepts conclusions at face value without any assessment of their merits or bases	Bailin Education	1993	Ennis derivative
50. 6) It involves in its most benign form " the correct assessing of statements" (Ennis, 1962)	Beyer Education	1985	Ennis original
51. Beyer uses the earlier version from Ennis: Experts in the study of critical thinking have for years been rather specific about what they mean by the term. Critical thinking, according to them and as used here, means judging the authenticity, worth, or accuracy of something.	Beyer Education	1987	Ennis original
52. As a root notion, ***critical thinking*** is taken to be the correct assessing of statements. Since there are various kinds of statements, various relations between statements and their grounds, and various stages in the process of assessment, we can expect that there will be various ways of going wrong when one attempts to think critically.	King & Kitchener Educational psychology	1994	Ennis original

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Definition	Author/Field	Date	Source
53. The correct assessing of statements (Ennis)	Lippman Education	2003	Ennis original
54. Critical thinking is the correct assessment of statements	Ennis Education	1963	Ennis original
55. the correct assessing of statements.	Bailin Education	1997	Ennis original
56. correct assessing of statements	Ennis Education	1963	Ennis original
57. Correct assessing of statements	Ennis Education	1962	Ennis original
58. A definition of critical thinking that I at one time endorsed is that critical thinking is the correct assessing of statements (Ennis, 1962).	Ennis Education/philosophy	1993	Ennis original
59. Critical thinking is a nonlinear, recursive process in which a person forms a judgment about what to believe or what to do in a given context" Credited to Facione, but is not the APA def.	Myrick Nursing	1998	Facione, related to Ennis
60. Critical thinking is the judging of statements based on acceptable standard. (Feeley 1976)	Beyer Education	1985	Feeley, related to Ennis
61. Critical thinking is skilled and active interpretation and evaluation of observations and communications, information and argumentation.	Fisher Philosophy	2001	Fisher
62. *Critical thinking is skilled, **active** interpretation and evaluation of **observations, communications,** information, and argumentation.* (Note: they also mention that you can add ***...as a guide to thought and action.*** to the definition, but they do not see the need to do so.)	Fisher & Scriven Philosophy	1997	Fisher & Scriven
63. what I call strong sense critical thinking: (a) an ability to question deeply his own framework of thought, (b) an ability to reconstruct sympathetically and imaginatively the strongest versions of points of view and frameworks of thought opposed to his own, and (c) an ability to reason dialectically (multilogically) in such a way as to determine when his own point of view is at its weakest and when an opposing point of view is at its strongest. (p. 377)	Paul Philosophy	1987	Foundation

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Definition	Author/Field	Date	Source
64. Critical thinking according to Richard Paul (1993) is "disciplined, self-directed thinking which exemplifies the perfections of thinking appropriate to a particular mode or domain of thinking" (p. 462). It is an art of thinking about one's thinking in order to make it more clear, accurate, or "more defensible." This type of thinking requires "the mastery of intellectual skills and abilities."	Jones et al. Education	1995	Foundation
65. R. Paul - thinking about your thinking while you're thinking to make your thinking better	Reed Education	1998	Foundation
66. R. Paul - a unique kind of purposeful thinking in which the thinker systematically and habitually imposes criteria and intellectual standards upon the thinking, taking charge of the construction of thinking, guiding the construction of the thinking according to the standards, assessing the effectiveness of the thinking according to the purpose, the criteria, and the standards.	Reed Education	1998	Foundation
67. Richard Paul and Michael Scriven have defined critical thinking as "the intellectual disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observations, experience, reflection, reasoning, or communication as a guide to belief and action"	Hatcher Education/philosophy	2000	Foundation
68. Critical thinking is that mode of thinking - about any subject, content or problem - in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them. (Paul, Fisher and Nosich,1993, p. 4)	Fisher Philosophy	2001	Foundation
69. An intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action .... Thinking about [our] thinking while [we're] thinking in order to make [our] thinking better.	Moore IA	2001	Foundation
70. Thinking that aims to overcome bias, prejudice, and stereotyping (Paul)	Lippman Education	2003	Foundation
71. Thinking that aims to protect us from deceptions by others and from self-deception (Paul)	Lippman Education	2003	Foundation
72. Thinking about thinking	Lippman Education	2003	Foundation
73. The ability of thinkers to take charge, to develop intellectual standards and apply them to their own thinking (Paul)	Lippman Education	2003	Foundation

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Definition	Author/Field	Date	Source
74. An intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action .... Thinking about [our] thinking while [we're] thinking in order to make [our] thinking better.	Moore IA	2003	Foundation
75. An intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action .... Thinking about [our] thinking while [we're] thinking in order to make [our] thinking better.	Moore & Krizan IA	2003	Foundation
76. From Paul: “a unique kind of purposeful thinking in which the thinker systematically and habitually imposes criteria and intellectual standards upon the thinking….	Cohen et al. Army	2004	Foundation
77. Paul, Elder, and Bartell (1997) defined critical thinking in their study on faculty knowledge as “thinking that explicitly aims at well-founded judgment and hence utilizes appropriate evaluative standards in the attempt to determine the true worth, merit, or value of something.”	Kelly-Riley et al. Education	2004	Foundation
78. Scriven and Paul (2003) define critical thinking as “the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by observation, experience, reflection, reasoning, or communication as a rubric to belief and action.”	Kelly-Riley et al. Education	2004	Foundation
79. Uses one of Richard Paul's definitions: Critical Thinking: (1) Disciplined, self-directed thinking that exemplifies the perfections of thinking appropriate to a specific mode or domain of thinking; (2) thinking that displays mastery of intellectual skills and abilities; (3) the art of thinking about one’s thinking while thinking, to make one’s thinking better: more clear, more accurate, or more defensible; (4) thinking that is fully aware of and continually guards against the natural human tendency to self-deceive and rationalize to selfishly get what it wants	Guillot Military	2004	Foundation
80. Skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them.	McLaughlin IA	2005	Foundation

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81. One way to summarize the essence of critical thinking is as follows: Critical thinking is the art of thinking about thinking in such a way as to: 1. identify its strengths and weaknesses, and 2. recast it in improved form (where necessary). The first characteristic requires the thinker to be skilled in analytic and evaluative thinking. The second requires the thinker to be skilled in creative thinking. Thus, critical thinking has three dimensions: the analytic, the evaluative, and the creative.	Paul & Elder Education/philosophy	2005	Foundation
82. the ability to step out of one's thoughts, if you will, to examine them and the process that brought them about even while you are thinking them.	Moore IA	2006	Foundation
83. ***Critical Thinking*** is a deliberate meta-cognitive *(thinking about thinking)* and cognitive *(thinking)* act whereby a person reflects on the quality of the reasoning process simultaneously while reasoning to a conclusion. The thinker has two equally important goals: coming to a solution and improving the way she or he reasons.	Moore IA	2006	Foundation
84. Critical thinking is the process of analyzing and assessing thinking with a view to improving it. Critical thinking presupposes knowledge of the most basic structures in thinking (the elements of thought) and the most basic intellectual standards for thinking (universal intellectual standards). The key to the creative side of critical thinking (the actual improving of thought) is in restructuring thinking as a result of analyzing and effectively assessing it.	Paul & Elder Education/philosophy	2006	Foundation
85. Critical thinking is the art of analyzing and evaluating thinking with a view to improving it.	Paul & Elder Education/philosophy	2007	Foundation
86. "Critical thinking is that mode of thinking-about any subject, content, or problem-in which the thinker improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it. Critical thinking is self-directed, self-disciplined, self-monitored, and self-corrective thinking'	Analysis 101 IA	2008	Foundation
87. Critical thinking is that mode of thinking about any subject, content, or problem in which the individual improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it. Critical thinking is largely self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes rigorous standards of excellence and mindful command of their use.	Bruce & George IA	2008	Foundation
88. ...the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication as a guide to belief and action. (Scriven, 1996)	Krupat Medical	2008	Foundation

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89. …the art of thinking about your thinking while you are thinking in order to make your thinking better: more clear, more accurate, and more defensible. (Paul et al., 1989) (p. 5) :	Krupat Medical	2008	Foundation
90. Critical thinking is self-guided, self-disciplined thinking which attempts to reason at the highest level of quality in a fair-minded way. Linda Elder The page also included a link to a "more complete" definition of CT.	Elder Education	2009	Foundation
91. Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness..."	Paul & Scriven Philosophy	2009	Foundation
92. "Critical thinking at AMSC is defined as disciplined, self-directed thinking displaying a mastery of intellectual skills and abilities—thinking about your thinking while you're thinking to make your thinking better."	Eichhorn Army	2010	Foundation
93. We also developed a series of shorthand labels such as "thinking about thinking"	Eichhorn Army	2010	Foundation
94. Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.	Paul & Scriven Philosophy	undated	Foundation
95. Critical thinking is self-guided, self-disciplined thinking which attempts to reason at the highest level of quality in a fair-minded way.	Paul & Scriven Philosophy	undated	Foundation
96. Critical thinking is that mode of thinking - about any subject, content, or problem - in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them.	Paul & Scriven Philosophy	undated	Foundation
97. Critical thinking is, in short, self-directed, self-disciplined, self-monitored, and self-corrective thinking.	Paul & Scriven Philosophy	undated	Foundation
98. Several definitions cited in course materials, Analysis 101. First was "The art of thinking about your thinking while you are thinking in order to make your thinking better: more clear, more accurate, or more defensible"	Analysis 101 IA	2008	Foundation, Binker, Adamson, & Martin

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99. As the former it involves (1) an alertness to the need to evaluate information, (2) a willingness to test opinions and (3) a desire to consider all viewpoints.	Beyer Education	1985	Fraser & West
100. Attentiveness to the formal aspects of thinking (Garver)	Lippman Education	2003	Garver
101. Discussion of argumentative literature drawn from traditional works of the humanities	Lippman Education	2003	Garver and Adler
102. The ability to think critically, as conceived in this volume, involves three things: (1) an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experiences, (2) knowledge of the methods of logical inquiry and reasoning, and (3) some skill in applying those methods. Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends. It also generally requires ability to recognize problems, to find workable means for meeting those problems, to gather and marshal pertinent information, to recognize unstated assumptions and values, to comprehend and use language with accuracy, clarity, and discrimination, to interpret data, to appraise evidence and evaluate arguments, to recognize the existence (or non-existence) of logical relationships between propositions, to draw warranted conclusions and generalizations, to put to test the conclusions and generalizations at which one arrives, to reconstruct one's patterns of beliefs on the basis of wider experience, and to render accurate judgments about specific things and qualities in everyday life.	Glaser Education	1941	Glaser With references to Dewey
103. An attitude of being disposed to consider in a thoughtful, perceptive manner the problems and subjects that come within the range of one's experience. 2. Knowledge of the methods of logical inquiry and reasoning. 3. Skill in applying those methods.	Zechmeister & Johnson Philosophy	1992	Glaser
104. Watson and Glaser (1964) view critical thinking as a composite of three elements: "(1) attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true; (2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and (3) skills in employing and applying the above attitudes and knowledge"	King & Kitchener Educational psychology	1994	Glaser

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105. (1) an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experience; (2) knowledge of the methods of logical enquiry and reasoning; and (3) some skill in applying those methods. Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends. (Glaser, 1941, p. 5)	Fisher Philosophy	2001	Glaser With references to Dewey
106. Halpern's (1984) book on critical thinking makes no mention of reflection and defines critical thinking merely as "thinking that is purposeful and goal directed" (p. 3).	Mezirow Education	1991	Halpern
107. Halpern - thinking that is purposeful, reasoned, and goal directed. It is the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions	Reed Education	1998	Halpern
108. Halpern (1997) asserts that critical thinking is the "use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned and goal directed" (p. 4). From a cognitive psychologist's view, she cites several other definitions from that perspective: critical thinking is the "formation of logical inferences"; it is the development of cohesive and logical reasoning and patterns; it is careful and deliberate determination of whether to accept, reject or suspend judgment; it is mental activity useful for a particular cognitive task (1997, p. 4).	Kelly-Riley et al. Education	2004	Halpern
109. I will use Diane Halpern's broad definition of critical thinking as a foundation: "Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed."5 In essence, critical thinking is about improving one's judgment.	Gerras Army	2006	Halpern
110. For example, Diane Halpern considers that [critical] thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is... thinking that is purposeful, reasoned, and goal directed - the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective to the particular context and type of thinking task.	Moore IA	2006	Halpern
111. Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed.	Allen & Gerras Army	2009	Halpern

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112. Halpern's recommended definition: Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task.	Halpern Psychology	2003	Halpern
113. Critical thinking is thinking that attempts to arrive at a judgment only after honestly evaluating alternatives with respect to available evidence and arguments	Hatcher Education/philosophy	2000	Hatcher
114. the honest evaluation of alternatives with respect to available evidence and arguments.	Hatcher Education	2001	Hatcher
115. Thinking that attempts to arrive at a judgment only after honestly evaluating alternatives with respect to available evidence and arguments (Hatcher)	Lippman Education	2003	Hatcher
116. IC employees are expected to use logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to effectively inform decisions and outcomes. Subskills include: creative thinking, exploring alternatives, enterprise perspective, situational awareness, synthesis	Spracher IA	2009	Intel Community Directive 610
117. From the NDIC Catalog. Includes the following topics as part of critical thinking: Situational awareness (global/area), creative thinking, synthesis, exploring alternatives	NDIC IA	2008	Intel Community Directive 610
Competencies for supervisory and managerial IC employees at GS-15 and below: 118. IC employees are expected to use logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to effectively inform decisions and outcomes. In addition, IC supervisors are expected to establish a work environment where employees feel free to engage in open, candid exchanges of information and diverse points of view. Subskills include: Decisiveness, Flexibility, Problem Solving	Office of the Director of National Intelligence IA	2008	Intel Community Directive 610
Competencies for non-supervisory IC employees at GS-15 and below: 119. IC employees are expected to use logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to effectively inform decisions and outcomes. Subskills include: creative thinking, exploring alternatives, enterprise perspective, situational awareness, synthesis	Office of the Director of National Intelligence IA	2008	Intel Community Directive 610

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120. **Critical Thinking.** Uses logic, analysis, synthesis, creativity, judgment, and systematic approaches to gather, evaluate, and use multiple sources of information to inform decisions and outcomes	Bennett IA	2008-09	Intel Community Directive 610
121. Critical thinking involves the dynamic reorganization of knowledge in meaningful and usable ways. It involves three general skills: evaluating, analyzing, and connecting	Jonassen Education	2000	Iowa Dept of Educ
122. Jones and his colleagues (Jones, Dougherty, Fantaske, & Hoffman, 1995; Jones, Hoffman, Moore, Ratcliff, Tibbetts, & Click, 1995) obtained consensus from among 500 policymakers, employers, and educators, who agree that critical thinking is a broad term that describes reasoning in an open-ended manner and with an unlimited number of solutions. It involves constructing a situation and supporting the reasoning that went into a conclusion.	Halpern Psychology	2003	Jones
123. Critical thinking is "a process wherein an interaction occurs between individuals and the interpretations of knowledge which they create" (Jones & Brown, 1991)	Perciful & Nester Nursing	1996	Jones & Brown
124. Knox (1977), who reviews over 1,000 studies of adult development and learning, only once mentions critical thinking, which he characterizes as including "the ability to interpret data, weigh evidence, and engage in deductive thinking" (p. 446).	Mezirow Education	1991	Knox
125. Thinking as argument (Kuhn, 1991, 1992; Yeh, 2002) offers a way to define what we mean by critical thinking. (p. 172)	Kuhn Educational psychology	2005	Kuhn
126. a conceptualization of critical thinking as careful argumentation, a notion rooted in classical rhetoric and elaborated by Billig and Kuhn (Billig, 1987; Kuhn, 1991, 1992, 1999)	Yeh Education	2001	Kuhn, Billig

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127. Critical thinking is a rational response to questions that cannot be answered definitively and for which all the relevant information may not be available. It is defined here as ***an investigation whose purpose is to explore a situation, phenomenon, question, or problem to arrive at a hypothesis or conclusion about it that integrates all available information and that can therefore be convincingly justified.*** In critical thinking, all assumptions are open to question, divergent views are aggressively sought, and the inquiry is not biased in favor of a particular outcome. The outcomes of a critical inquiry are twofold: a ***conclusion*** (or hypothesis) and the ***justification*** offered in support of it. These outcomes are usually set forth in the form of an ***argument,*** defined as "the sequence of interlinked claims and reasons that, between them, establish the content and force of the position for which a particular speaker is arguing" (Toulmin, Rieke, and Janik 1979, p. 13). The need for justification arises from the ill-defined nature of problems to which the term "critical thinking" generally applies. Because conclusions cannot be tested (as they can be in problem solving), the arguer must demonstrate their plausibility by offering supporting reasons (Voss, Tyler, and Yengo 1983). The inquiry itself, in which evidence is reviewed and interpreted, is sometimes referred to as "the context of ***discovery";*** it is the inventive, creative phase of critical thinking. The presentation of the argument is referred to as "the context ***of justification"*** (Kahane 1980; McPeck 1981). In practice, the two may be intertwined rather than distinct. (p. 20)	Kurfiss Education	1988	Kurfiss
128. an investigation whose purpose is to explore a situation, phenomenon, question, or problem to arrive at a hypothesis or conclusion about it that integrates all available information and that therefore can be convincingly justified.	Inch & Warnick Communications	2010	Kurfiss
129. Definitions of critical thinking, such as that of Lipman (1988, p. 39), who argues that "critical thinking is skillful, responsible thinking that facilitates good judgment because it (1) relies upon criteria, (2) is selfcorrecting, and (3) is sensitive to context."	King & Kitchener Educational psychology	1994	Lipman
130. Matt Lipman defines critical thinking as "skillful, responsible thinking that facilitates good judgment because it 1) relies on criteria, 2) is self-correcting and 3) is sensitive to context"	Hatcher Education/philosophy	2000	Lipman
131. 'Critical thinking is thinking that facilitates judgment because it relies on criteria, is self-correcting, and is sensitive to context.' (Lipman)	Hare Education	1999	Lipman

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132. Litecky (1992) defines critical thinking as "the active, mental effort to make meaning of our world by carefully examining thought in order to better understand content" (p. 83).	Jonassen Education	2000	Litecky
133. Thinking aimed at the integration of thought and action (J. R. Martin)	Lippman Education	2003	Martin
134. it is the appropriate use of reflective scepticism within the problem area under consideration.	McPeck Educational philosophy	1981	McPeck
135. Critical thinking has two important dimensions. It is both a frame of mind and a number of specific mental operations (McPeck, 1981)	Beyer Education	1985	McPeck
136. McPeck (1990) views critical thinking as important within the context of the disciplines and the knowledge within those fields. Only through an immersion in the disciplines can individuals fully develop their abilities to think critically. McPeck includes actions as well as beliefs in his definition. He also advocates the importance of "reflective skepticism" which encourages the individual to find the faults of others.	Jones et al. Education	1995	McPeck
137. John McPeck defines critical thinking as "the skill and propensity to engage in an activity with reflective skepticism"	Hatcher Education/philosophy	2000	McPeck
138. Thinking that enables critical skills to be transferred to educational subjects	Lippman Education	2003	McPeck
139. Thinking that comes in or may come in when we suspect something to be amiss	Lippman Education	2003	McPeck
140. Thinking that represents the philosophy of x, for the philosophy of x should ideally be an integral part of what it means to learn x	Lippman Education	2003	McPeck
141. Reflective skepticism	Lippman Education	2003	McPeck
142. 'Critical thinking is the appropriate use of reflective scepticism within the problem area under consideration.'	Hare Education	1999	McPeck
143. Advanced Analysis includes a chapter on critical thinking. This definition comes from a psychology book David G. Myers. *Exploring Psychology,* 5th ed., (New York: Worth, 2003. Definition is: An intellectual process that "examines assumptions, discerns hidden values, evaluates evidence, and assesses conclusions.	Hall & Citrenbaum IA	2010	Myers
144. "The ability to judge the plausibility of specific assertions, to weigh evidence, to assess the logical soundness of inferences, to construct counter arguments and alternative hypotheses"	Analysis 101 IA	2008	Nickerson, Perkins, & Smith

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145. Thinking appraisively about any human product, whether said, made, or done	Lippman Education	2003	No source
146. Thinking explicatively and interpretively, as critics do	Lippman Education	2003	No source
147. The application of theoretical thinking to practical, problematic situations	Lippman Education	2003	No source
148. Reflections upon the causes and consequences of what happens	Lippman Education	2003	No source
149. The reflective assessment of practice	Lippman Education	2003	No source
150. Thinking that considers how to facilitate communication between experts and the world	Lippman Education	2003	No source
151. A systematic search for the reasons by which one's thinking can be justified	Lippman Education	2003	No source
152. Thinking that seeks to disclose the persuasive aspects of all explanation, while holding that all explanation is argument	Lippman Education	2003	No source
153. Thinking that examines differences of interpretation resulting from differences in contexts, conceptual schemes, and points of view	Lippman Education	2003	No source
154. A light version of philosophy	Lippman Education	2003	No source
155. The testing of claims	Lippman Education	2003	No source
156. Literacy (David Olson)	Lippman Education	2003	Olson
157. According to Pascarella and Terenzini (1991, p. 118), "critical thinking appears to stress the individual's ability to interpret, evaluate, and make informed judgments about the adequacy of arguments, data, and conclusions."	King & Kitchener Educational psychology	1994	Pascarella and Terenzini
158. Thinking that contains enabling skills (e.g., principles of reasoning, skills of logic) as well as skills shared across fields of expertise (Resnick)	Lippman Education	2003	Resnick
159. Critical thinking is the process of examining … materials in the light of related objective evidence, comparing the object or statement with some norm or standard, and concluding or acting upon the judgment then made. (Russell, 1956)	Beyer Education	1985	Russell

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160. One of my favorite definitions of critical thinking was published over 40 years ago (1960) and comes very close to this contemporary notion of critical thinking as a learnable skill: "Critical thinking then is the process of evaluation or categorization in terms of some previously accepted standards . . . this seems to involve attitude plus knowledge of facts plus some thinking skills" (Russell, cited in d'Angelo, 1971, p. 6). In short, Russell's equation is: Attitude + Knowledge + Thinking Skills = Intelligent Thinking	Halpern Psychology	2003	Russell
161. Nursing specific consensus definition (2000): Critical thinking is an essential component of professional accountability and quality nursing care. Critical thinkers in nursing exhibit these habits of the mind: confidence, contextual perspective, creativity, flexibility, inquisitiveness, intellectual integrity, intuition, open-mindedness, perseverance, and reflection. Critical thinkers in nursing practice the cognitive skills of analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting and transforming knowledge. (p. 7)	Staib Nursing	2003	Self
162. Introduction to the Cambridge Handbook of Thinking and Reasoning, provides a definition for Thinking (general rather than critical): Thinking is the systematic transformation of mental representations of knowledge to characterize actual or possible states of the world, often in service of goals.	Holyoak & Morrison Psychology	2005	Self
163. LOGIC can be briefly defined as the study of reasoning. The study of any subject calls for thought, and every student is, or ought to be, a thinker; but he is not a student of logic unless he thinks about reasoning. Now reasoning is itself a special kind of thinking; hence the special kind of study known as logic is concerned with thinking about thinking.	Max Black Philosophy	1952	Self
164. Definition of higher order thinking: Students engage in purposeful, extended lines of thought during which they: • Identify the task or problem type. • Define and clarify essential elements and terms. • Judge and connect relevant information. • Evaluate the adequacy of information and procedures for drawing conclusions and/ or solving problems.	Quellmalz Education	1985	Self HOT

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165. Beyer's anti definition: The term ***critical thinking*** is one of the most abused terms in our thinking skills vocabulary.* Generally it means whatever its users stipulate it to mean. In some circles the term ***critical thinking*** is used to mean all thinking operations, from decision making to analysis of part-whole relationships to interpreting. In other circles it means the skills drawn from Bloom's taxonomy. Yet critical thinking is ***not*** to be considered as encompassing all, or identical to any, of these operations. Critical thinking, for example, is obviously not the same as recall. Neither is critical thinking synonymous with decision making or problem solving.	Beyer Education	1987	Self
166. Critical thinking has been defined as the ability "to recognize relevance, dependability, bias in sources, and adequacy.	Prawat Education	1991	Self
167. Critical thinking means correct thinking in the pursuit of relevant and reliable knowledge about the world.	Schafersman Education	1991	Self
168. Critical thinking can be described as the scientific method applied by ordinary people to the ordinary world.	Schafersman Education	1991	Self
169. At a practical level, critical thinking is effective, adaptive thinking	Zechmeister & Johnson Philosophy	1992	Self
170. Critical thinking is an important attribute-the ability to critique the sources and not assume that because some information is on paper and was acquired clandestinely it must be good.	Graves IA	1994	Self
171. the key survival skill that the human brain must master without help from computers.	Fisher & Scriven Philosophy	1997	Self
172. a 'second-order skill' that involves the intelligent use of knowledge and reasoning to weigh the value of claims to knowledge.	Fisher & Scriven Philosophy	1997	Self
173. Critical thinking is the cutting edge of thought	Fisher & Scriven Philosophy	1997	Self
174. Critical thinking is thinking with integrated quality control.	Fisher & Scriven Philosophy	1997	Self
175. The process of figuring out what to believe or not about a situation, phenomenon, problem or controversy for which no single definitive answer or solution exists. The term implies a diligent, open-minded search for understanding, rather than for discovery of a necessary conclusion.	Mumm & Kersting Education	1997	Self

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176. Critical thinking is a broader term describing reasoning in an open-ended manner, with an unlimited number of solutions. The critical thinking process involves constructing the situation and supporting the reasoning behind a solution.	NCEC Education	2000	Self
177. Critical thinking involves evaluating a situation, problem, or argument and choosing a path of investigation that leads to finding the best possible answers.	Feldman Unknown	2002	Self
178. Critical thinking is not knowledge about a problem but is a skill of examining and thinking about a problem. It begins with questioning what others believe to be fact and realizing that there is more than one way of examining a problem.	Boba Law enforcement	2003	Self
179. Oermann (1997) defined critical thinking as the thought process that underlies effective clinical problem solving and decision making.	Staib Nursing	2003	Self
180. Alfaro-LeFevre (1999) described critical thinking in nursing as purposeful, outcome directed thinking driven by patient needs and based on principles of the nursing process and scientific method.	Staib Nursing	2003	Self
181. Normative analytic methods follow the general principles of *critical thinking* that carefully define problems, then identify assumptions, decision criteria, evidence and alternative solutions before evaluating the effects of alterative solutions to arrive at an optimal decision.	Waltz IA	2003	Self
182. Critical thinking is based on the application of a systematic method to guide the collection of evidence, reason from evidence to argument, and apply objective decision-making judgment (Table 4.10). The systematic methodology assures completeness (breadth of consideration), objectivity (freedom from bias in sources, evidence, reasoning, or judgment), consistency (repeatability over a wide range of problems), and rationality (consistency with logic). In addition, critical thinking methodology requires the explicit articulation of the reasoning process to allow review and critique by others. (p. 144)	Waltz IA	2003	Self
183. critical thinking is asking and answering questions about alternative possibilities in order to achieve some objective. Critical thinking is (1) a question and answer (or more specifically, a challenge and defend) dialogue with oneself or others (2) about alternative possibilities (3) carried out for a purpose	Cohen et al. Army	2004	Self
184. Critical thinking is manifest in mindfulness, investment of mental effort, and willingness to take intellectual risks.	Florence & Yore Education	2004	Self

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185. A more concise definition of critical thinking is: the ability to logically assess the quality of one's thinking and the thinking of others to consistently arrive at greater understanding and achieve wise judgments.	Guillot Military	2004	Self
186. In this handbook, "critical thinking" means sound thinking needed by practitioners in an academic discipline: accurate, relevant, reasonable, rigorous—whether it be analyzing, synthesizing, generalizing, applying concepts, interpreting, evaluating supporting arguments and hypotheses, solving problems, or making decisions.	Prince George Comm. College Education	2004	Self
187. Indeed, for most thinking abilities that might be considered naturally occurring, one can usually identify a more sophisticated form that such thinking might take with some deliberate nurturing. This type of thinking is what is often referred to as high-end thinking or critical and creative thinking. Such thinking extends beyond a natural processing of the world into the realm of deliberative thinking acts aimed at solving problems, making decisions (see LeBoeuf & Shafir, Chap. 11), and forming conclusions.	Perkins & Ritchhart Education	2005	Self
188. critical thinking involves examining possibilities carefully, fairly, and constructively, and then focusing your thoughts and actions by: • organizing and analyzing possibilities, • refining and developing promising possibilities, • ranking or prioritizing options, and • choosing or deciding on certain options.	Treffinger, Isaksen, Stead-Dorval Educational psych	2005	Self
189. When all things have been considered, critical thinking is found to make three important demands. It insists on clearness. The critical thinker is always asking such questions as: Just what did we see? Just what were the sounds we heard? What were the exact words used? What did he really mean to say? What did he do? What did he mean to do? Critical thinking makes a persistent demand for all the actual facts in the case. It has no patience with merely alleged facts. It rebels against all reports which are "made to order" and "fixed" to suit the supposed needs of the hearer. Finally, critical thinking is effective thinking; it demands results. It is opposed to speculations which lead nowhere. It objects to everything that is irrelevant and immaterial. To some people critical thinking has meant merely the type of thinking that demands clearness and truth. It means more than that. It insists that the particular truth which we hold shall be one that has value in reaching a conclusion.	Boraas Education	1922	Self
190. At Frostburg State University, critical thinking is defined as reflective, self-directed thinking that requires skills in reasoning and the dispositions to use those skills so that a person can think effectively about questions, problems, and decisions both inside and outside of the classroom.	Bensley et al. Education	2006	Self With some influence from Dewey & Ennis

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191. Critical thinking is a term used to refer to those kinds of mental activity that are clear, precise and purposeful. It is typically associated with solving complex real-world problems, generating multiple – or creative – solutions to a problem, drawing inferences, synthesising and integrating information, distinguishing between fact and opinion, or estimating potential outcomes, but it can also refer to the process of evaluating the quality of one's own thinking.	Hart & Simon IA	2006	Self Ref to foundation also
192. Critical thinking consists of seeing both sides of an issue, being open to new evidence that disconfirms your ideas, reasoning dispassionately, demanding that claims be backed by evidence, deducing and inferring conclusions from available facts, solving problems, and so forth.	Willingham Education	2007	Self
193. Critical thinking is quality control for problem solving and reasoning. Critical thinking enables you to judge the accuracy and relevance of your information, categorize information as assumption, fact, or inference, identify gaps in your knowledge, recognize factors that influence your objectivity and the objectivity of others, and judge the validity of your arguments.	Analysis 101 IA	2008	Self
194. Intentionally applying rigorous analytic procedures to relevant analyst problems for reliable analytic products. Each approach to critical thinking has, then, three dimensions: procedures, problems, and products. The procedures are methods of reasoning that the approach offers. The problems are the challenges that the procedures are designed to address. And, the products are the results of applying the procedures to the problems. So, the approaches can be distinguished in terms of differences in their procedures, problems, and products.	Hendrickson IA	2008	Self
195. Critical thinking, therefore, may be defined as the process by which we test claims and arguments and determine which have merit and which do not. In other words, critical thinking is a search for answers, a quest.	Ruggiero Education	2008	Self
196. Critical thinking involves analyzing a problem in depth, which in turn often requires extrapolation and the projection of observed patterns and trends into the long- or short-term future based on statistics and mathematical probability. Such trend projection is typical in the related group of disciplines known as neoclassical economics, operations research, management science, and decision theory. It relies on strict deductive inference from given premises, including the precept that man is a utility-maximizing "rational actor" ("economic man"). (p. 270)	Smith IA	2008	Self

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197. definition for higher order thinking which includes both critical and creative thinking: Higher-order thinking is the mental engagement with ideas, objects, and situations in an analogical, elaborative, inductive, deductive, and otherwise transformational manner that is indicative of an orientation toward knowing as a complex, effortful, generative, evidence-seeking, and reflective enterprise.	Alexander et al. Education	2009	Self HOT
198. critical thinking is the careful application of reason in the determination of whether a claim is true.	Moore & Parker Philosophy	2009	Self
199. We also developed a series of shorthand labels such as "quality control of the mind."	Eichhorn Army	2010	Self
200. Critical thinking is an organized and disciplined way of thinking. It is thinking logically with clarity and precision; using an approach that is fair and accurate; focusing on information that is relevant. Also introduced a new concept: Applied critical thinking is: Taking a fair-minded approach to thinking logically and comprehensively about a particular situation, then identifying an appropriate course of action	Ishikawa Business	Unknown (recent)	Self
201. Critical Thinking is the ability to logically and comprehensively evaluate a situation and identify the most appropriate course of action.	Action Mgt Assoc Business	Undated	Self
202. In this paper, critical thinking is regarded as the set of intellectual processes or operations that occur when people respond critically to instances of valid and invalid reasoning, argument or evidence. Major elements of CT are (1) the process of discriminating between valid and invalid instances, on the basis of acceptable criteria, (2) the process of identifying defects in invalid instances on the basis of acceptable criteria, and (3) the process of responding critically to invalid instances.	Wright Education	1977	Self
203. Although managers did not elaborate on what they meant by critical thinking, this term generally refers to a process of purposeful thinking about a subject that employs logic, examination of the evidence and assumptions, and evaluation of the thinking process itself.	Derbentseva, McLellan, Mandel, IA	2010	Self
204. Critical thinking is the disciplined mental activity of evaluating arguments or propositions and making judgments that can guide the development of beliefs and taking action.	Huitt Psychology	1998	Self, but based on Ennis
205. "Construction of a logical argument based on rigorous weighing of evidence and assumptions, and the assessment of multiple hypotheses, resulting in accurate, persuasive, and policy-relevant conclusions"	Analysis 101 IA	2008	Sherman Kent School

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206. "reasons" conception of critical thinking, according to which a critical thinker is one who is *appropriately moved by reasons.*	Siegel Education & philosophy	1988	Siegel
207. Siegel (1988) notes "a critical thinker is one who is appropriately moved by reasons: she has a propensity and disposition to believe and act in accordance with reasons; she has the ability to assess the force of reasons in the many contexts in which reasons play a role" (p. 23). Siegel's theory asserts a close connection between critical thinking, rationality, and problem solving.	Jones et al. Education	1995	Siegel
208. For Siegel the reason-assessment component is central to critical thinking and involves the ability properly to assess reasons and their ability to warrant beliefs, claims and actions	Bailin Education	1997	Siegel
209. Siegel's definition of critical thinking is thinking that is "appropriately moved be reasons"	Hatcher Education/philosophy	2000	Siegel
210. Thinking performed by those who are appropriately moved by reasons (Siegel)	Lippman Education	2003	Siegel
211. From Siegel: …being a critical thinker requires basing one's beliefs and actions on reasons… the beliefs and actions of the critical thinker, at least ideally, are justified by reasons for them which she has properly evaluated [italics in original].	Cohen et al. Army	2004	Siegel
212. 'Critical thinking is thinking which appropriately reflects the power and convicting force of reasons.' (Siegel)	Hare Education	1999	Siegel
213. 'Critical thinking is the conscious, deliberate rational assessment of claims according to clearly identified standards of proof.' (Soccio)	Hare Education	1999	Soccio
214. Construed broadly, critical thinking comprises the mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts.	Sternberg Psychology	1986	Sternberg
215. Thinking that helps us solve problems and make decisions (Sternberg)	Lippman Education	2003	Sternberg
216. In a recent review of the critical thinking literature, Fischer and Spiker (2000) found that most definitions for the term "critical thinking" include reasoning/logic, judgment, metacognition, reflection, questioning, and mental processes.	Halpern Psychology	2003	summary
217. definition of thinking – not of CT: "That brings us close to the definition of thinking we promised earlier. What is it that really goes on in the mind? To us, it's nothing less than the making of meaning. And we mean making in its most literal sense—as in "making sense" and "making up our minds." We're convinced that every mind creates its own understanding by pulling things together in its own way, and "thinking" is what we call that process."	Kirby and Kuykendall Education	1991	Thinking in general, not CT Self generated.

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218. from Walters: Walters holds that there is a more holistic view of rationality, one that includes, along with the logical processes, intuition, imagination, conceptual creativity, and insight. He argues that much of the bandwagon effect of critical thinking assumes that critical thinking is logical thinking. Although Walters agrees (as do I) that logical inference, critical analysis, and problem solving are fundamental elements of good thinking, they are practically useful only if they are supplemented by imagination, insight, and intuition, which he considers essential components of discovery.	Jonassen Education	2000	Walters

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LIST OF ACRONYMS

ACH	Analysis of Competing Hypotheses
ACT	American College Test
APA	American Philosophical Association
ATIC	Advanced Technical Intelligence Center
CCTDI	California Critical Thinking Dispositions Inventory
CCTST	California Critical Thinking Skills Test
CIA	Central Intelligence Agency
CLA	Collegiate Learning Assessment
COCOM	Combatant Command
CT	Critical Thinking
CTSA	Critical Thinking and Structured Analysis
DIA	Defense Intelligence Agency
DNI	Director of National Intelligence
FAC	Framework for Analytic Cognition
FIA	Fundamentals of Intelligence Analysis
HECB	Higher Education Coordinating Board
HCTA	Halpern Critical Thinking Assessment
IC	Intelligence Community
ICD	Intelligence Community Directive
IQ	Intelligence quotient
ISA	International Studies Association
LAMP	Lots of Argument Mapping Practice
NASIC	National Air and Space Intelligence Center
NIE	National Intelligence Estimate
NIPF	National Intelligence Priorities Framework
ODNI	Office of the Director of National Intelligence
QPH	Quality Practice Hypothesis
SAT	Scholastic Aptitude Test
SD	School District
TIACRITIS	Teaching Intelligence Analysts Critical Thinking Skills
WGCTA	Watson-Glaser Critical Thinking Assessment
WSU	Washington State University

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